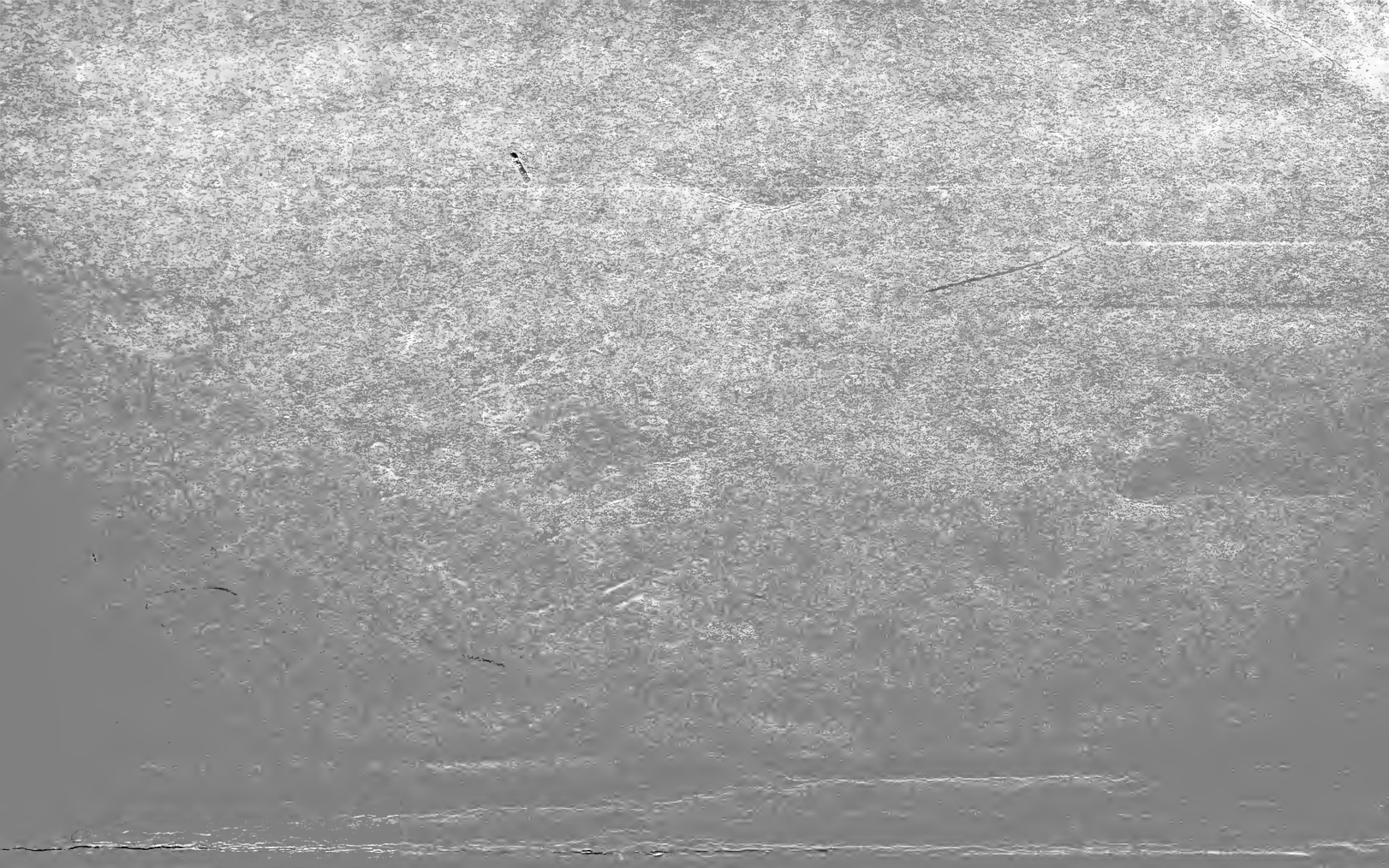

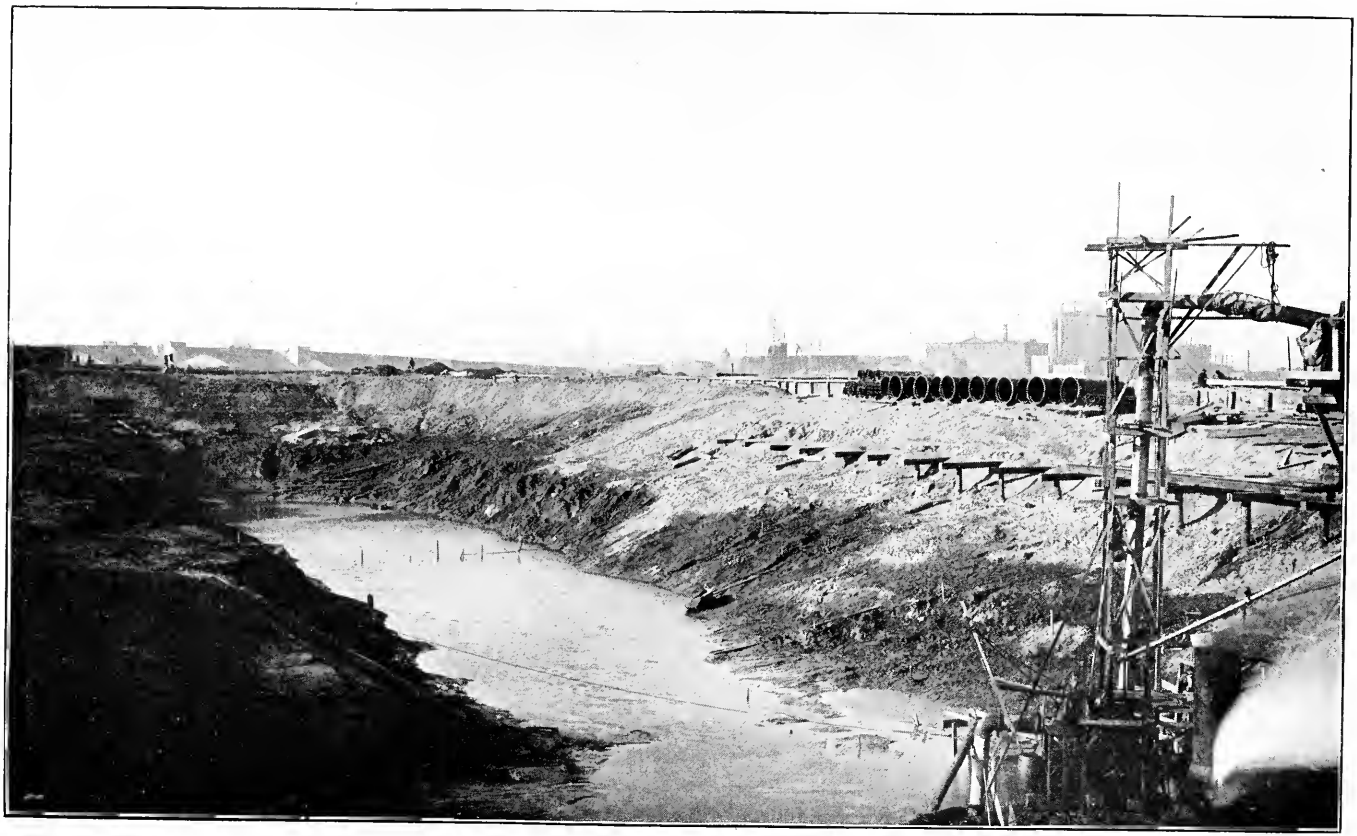

BOSTON COFFER-DAM — EXCAVATION FOR LOCK.

PUBLIC DOCUMENT . . . . . No. 71.

FOURTH ANNUAL REPORT

OF THE

CHARLES RIVER BASIN COMMISSION.

DECEMBER 1, 1906.

BOSTON:
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1907.

Approved by

The State Board of Publication.

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ILLUSTRATIONS.

Commonwealth of Massachusetts.

FOURTH REPORT OF THE COMMISSION.

To His Excellency the Governor and the Honorable Council of the Commonwealth of Massachusetts.

The Commission appointed under chapter 465 of the Acts of the year 1903, called the Charles River Basin Commission, has the honor to make the following report of its proceedings for the fiscal year ending Nov. 30, 1906, instead of September 30, as in previous years. This change is made to comply with chapter 211 of the Acts of 1905. As required by law, the Commission filed, on Jan. 16, 1907, with the Secretary of the Commonwealth a statement of its expenditures and receipts, which is printed herewith.

I. Summary of Work done by the Commission during its First Term of Office.

In the three years and four months from the date of its appointment to the end of the fiscal year covered by this report, the Commission has spent $946,638.23. The work which this money has paid for may be summarized as follows: —

Old Craigie Bridge has been removed.

A new Craigie Temporary Bridge has been built and new approaches laid out and paved. About $23,000 have been spent for the maintenance of this bridge, over which passes what is perhaps the heaviest traffic by teaming entering and leaving Boston on its northerly side. In providing the temporary bridge the Commission was able to utilize the Boston & Lowell freight bridge, at an estimated saving of $15,000 to $20,000.

One-third mile of the 7-foot Boston Marginal Conduit has been completed, thoroughly tested, and found to be first-

class in every particular. About 1½ miles of this conduit and ⅓ mile of the Cambridge Marginal Conduit yet remain to be constructed.

Piles have been driven and capped along 1 mile of frontage on the wharves of the Basin and on the Broad and Lechmere canals.

Four hundred thousand cubic yards of dredging have been done in the Basin and in the canals.

Work has been started upon the lowering of pipes, to prevent interference with navigation in the canals.

A coffer-dam, enclosing about 4½ acres of what was once the bottom of Charles River, has been constructed, and in it has been built the masonry work for many of the permanent hydraulic appurtenances of the Dam and the Boston Marginal Conduit, besides a Lock 490 feet long (which includes a draw at the lower end), 45 feet wide, and 27 feet deep at mean high tide. This has been known as the "Boston Coffer-dam." *Fig. 1* shows the pile foundations for the structures to be built within the Boston coffer-dam. *Fig. 2* shows the masonry construction within the Boston coffer-dam.

In a smaller coffer-dam on the other side of the river, known as the "Cambridge Coffer-dam," nine sluices have been erected. The middle sluice of this series has been arranged to serve a double purpose, so that when not in use as a sluice it may be operated as a lock for small boats which do not require so much head-room as to prevent their passage under the roadway, which will be at a level of 21 feet above mean low-water mark.

Preparations have been made for suitable approaches to the Dam.

Work has been begun on the Boston Embankment.

In connection with these various works the Commission has caused to be laid 35,700 cubic yards of concrete and has driven 490,000 linear feet of piles.

The Commission brought to public notice and proved the extent to which the city of Boston was allowing the Stony Brook channels to be polluted by sewage.

The Legislature, by chapter 520 of the Acts of 1906, having given to the Boston Elevated Railway Company the right to

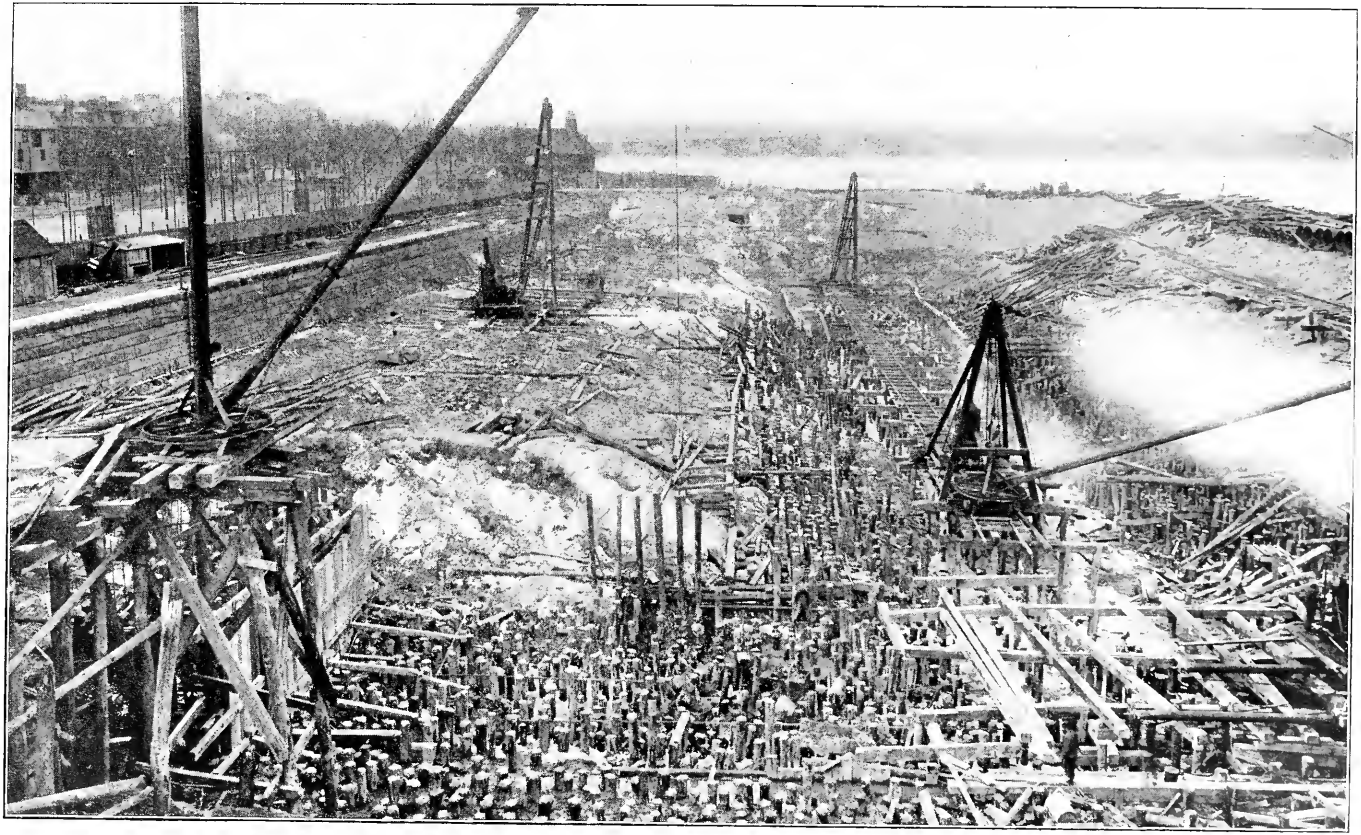


Fig. 1. LOCK—FOUNDATION PILES.

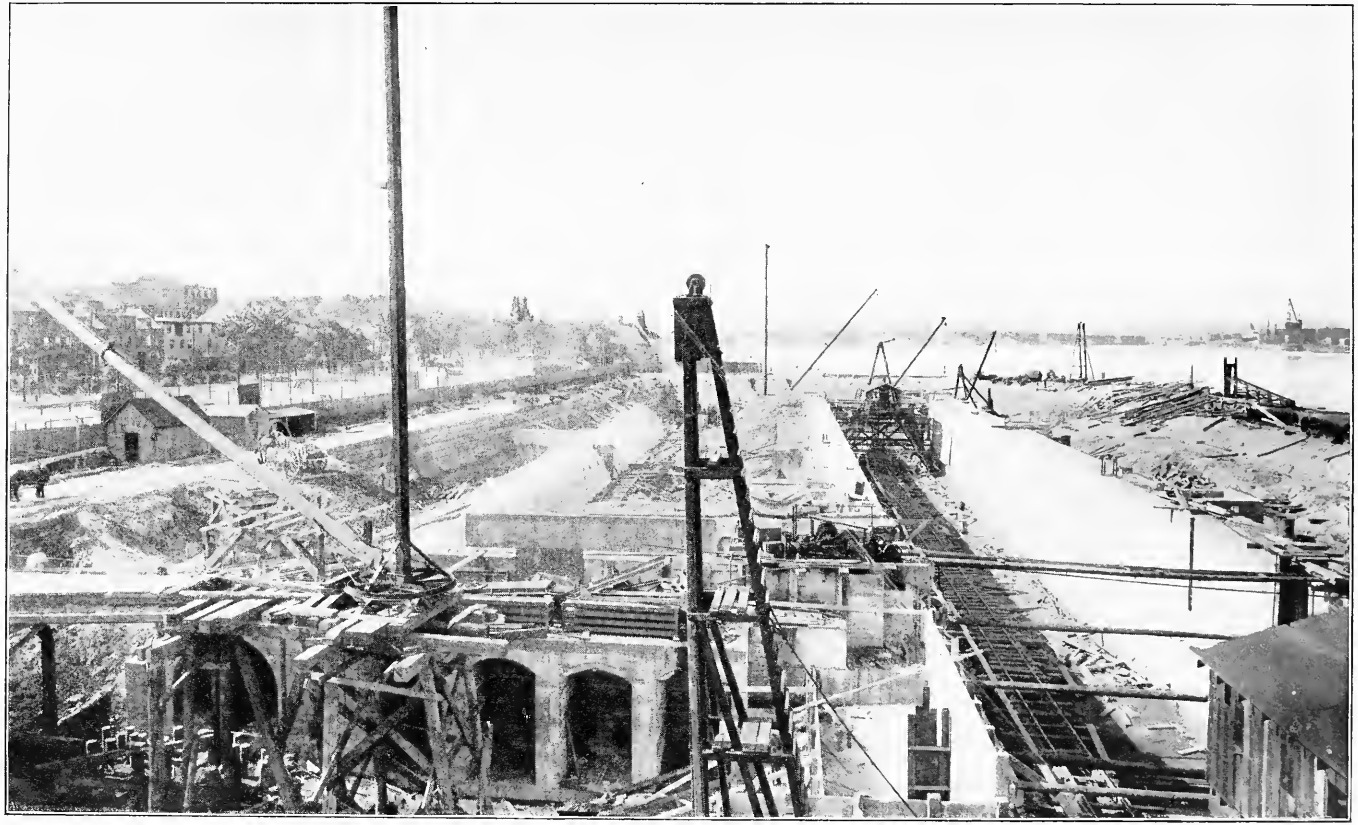


Fig. 2. LOCK AND BOSTON MARGINAL CONDUIT.

build an elevated structure on the down-stream slope of the Dam, the Commission has used its best endeavor, with the Board of Railroad Commissioners and otherwise, to keep the foundation of the Company's structure separate and independent of the foundations of the Dam, Lock and sluices.

The administrative details connected with the work above enumerated, and many other items not mentioned, have been handled with the utmost despatch consistent with safety.

All the Commission's work has been done without delay to traffic over the highway and without seriously interfering with navigation.

The cost of all the work done thus far is below the estimates presented to the Legislature of 1903.

II. Organization and Administration.

(*a*) *The Commission, Officers and Employees.*

On Aug. 1, 1906, the Commissioners were reappointed, and on August 7 they qualified, for a second term of three years. The membership of the Commission is the same as stated in the last report: Henry S. Pritchett, Chairman, Henry D. Yerxa and Joshua B. Holden. William S. Youngman has continued as Secretary, and Hiram A. Miller as Chief Engineer.

The administrative office force has remained the same this year as last. At the end of the year there were twenty-eight additional engineers and inspectors in the employ of the Commission. Promotions and other changes in the engineering force will be described in the report of the Chief Engineer, appended.

The Commission has been somewhat hampered by the difficulty of obtaining a sufficient number of engineers for all departments of its work.

(*b*) *Offices and Buildings.*

The office of the Charles River Basin Commission is located, as in previous years, on the sixth floor of the Standish building, No. 367 Boylston Street. The principal field office is at No. 12 Bridge Street, East Cambridge, near the Cambridge end of Craigie Bridge. During the past year a second field office has

been opened, on the edge of the Boston Embankment, at the foot of Chestnut Street. The Commission also has a storehouse and work shed located at the foot of Leverett Street, near the Boston end of Craigie Bridge.

III. The Dam and Lock.

Work under the contract for the Dam and Lock (Contract No. 1) has been going forward with great rapidity during the year. Besides Contract No. 1, 31 smaller contracts have been signed for various machinery and fittings for the Dam and Lock. In the aggregate, upon all these contracts the Commission has expended during the year $281,576.

(*a*) *Work in Coffer-dam on Boston Side.*

On Oct. 11, 1905, the work of pumping out the coffer-dam on the Boston side was begun. The water was lowered gradually, in order to permit the slopes to drain. On November 1 the pumping was practically completed, the water being lowered to a distance of about 35 feet below low tide.

Driving piles for the foundations of the Lock was started on November 1. On April 3, 1906, the first concrete was laid at the lower gate recess, and throughout the remainder of the year this work was continually in progress.

All the Lock structure is completed, and the granolithic walk on top of the Lock walls is finished from the upper end of the Lock to within 30 feet of the lower gate recess.

The track girders for the drawbridge over the Lock have been embedded in the concrete.

(*b*) *Work in Coffer-dam on Cambridge Side.*

The work of pumping out this smaller coffer-dam was completed on June 27, since which time some 3,000 cubic yards of concrete masonry have been placed within the coffer-dam, leaving about 500 cubic yards still to be laid.

(*c*) *The Shut-off Dam. — It will bring Fresh Problems.*

By reason of a temporary dam which the Commission will construct between the Boston and Cambridge coffer-dams, the public will have the use of the Basin at an earlier date than

SLUICES — UP-STREAM FACE.

was anticipated. In a preliminary way the Basin will be established, for with the shut-off dam it is intended to maintain the level of the Basin at the grade of 8 feet above Boston base, or about 2½ feet below the average high tide. This shut-off dam will permit more rapid work upon the retaining walls and the earth fill of the permanent Dam and roadway. When the shut-off dam is operated the Commission will have an opportunity to work out in a practical way many problems which it has already considered theoretically. The interval between the operation of the shut-off dam and the completion of the permanent Dam will be the most difficult period of the Commission's work. The transformation into a fresh-water lake of a tidal estuary having 17½ miles of shore line is radical. The Commission has given much study to the probable effects of this change, and will endeavor to be prepared to meet all emergencies promptly as they arise. Many problems relating to the Basin can only be solved with certainty of success after the shut-off dam has been operated. The Commission is mindful of the fact that most of the territory contiguous to the Basin is filled land. On such land most of the buildings have their foundations resting upon piles. The Commission is seeking to adjust all its works in a way that will preserve foundation piles in as good condition as they are maintained under present conditions. Sanitary questions are also involved in the operation of the shut-off dam.

It was originally planned to complete the shut-off dam, and thus arrest the tidal flow in the river, about Aug. 1, 1907, but the Legislature of 1906 enforced upon the Commission a delay in this matter. The work of building the Boston Embankment, assigned in the Charles River Basin Act to the city of Boston, was turned over to this Commission by chapter 402 of the Acts of 1906. To build the embankment wall at a minimum cost to the city will require the postponement of the completion of the shut-off dam until a later date.

IV. The Boston Embankment.

The Legislature's directions relative to the Boston Embankment are printed in Appendix A as an amendment to chapter 465 of the Acts of 1903. The limits of the embankment are

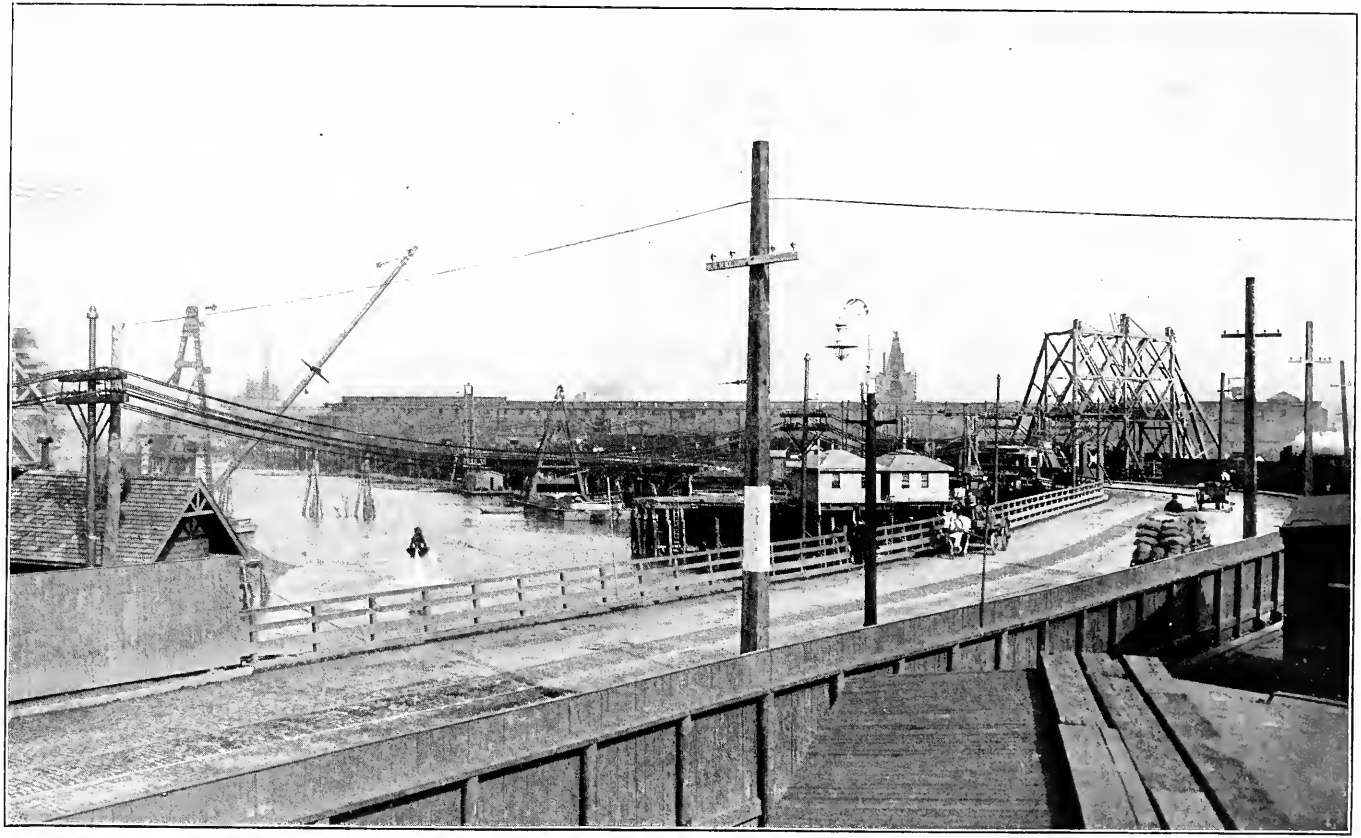
defined by law. From Charlesgate West easterly to a point near Berkeley Street it is to be 100 feet wide, and from that point it will curve to a point at right angles to the harbor line at the foot of Mt. Vernon Street, where it will be 300 feet wide; from that point it will gradually diminish in width until at a point near the Cambridge Bridge it will be about 200 feet wide.

On the wider portion of the embankment, in the rear of Charles and Brimmer streets, besides a park there will be a roadway and sufficient area along the water front for the location of boat-houses. It is not planned to extend the driveway beyond Otter Street. The embankment, back of Beacon Street from Otter Street westerly to Charlesgate West, according to present plans, is to have a walk along the water side, seats back of the walk, and the remainder is to be devoted to greensward and to planting. The Commission hopes it may be possible to so arrange the planting next to Back Street as to conceal as far as possible from the view of people on the embankment and on the Basin the unsightliness of that street and the stables in the rear of the houses on the north side of Beacon Street.

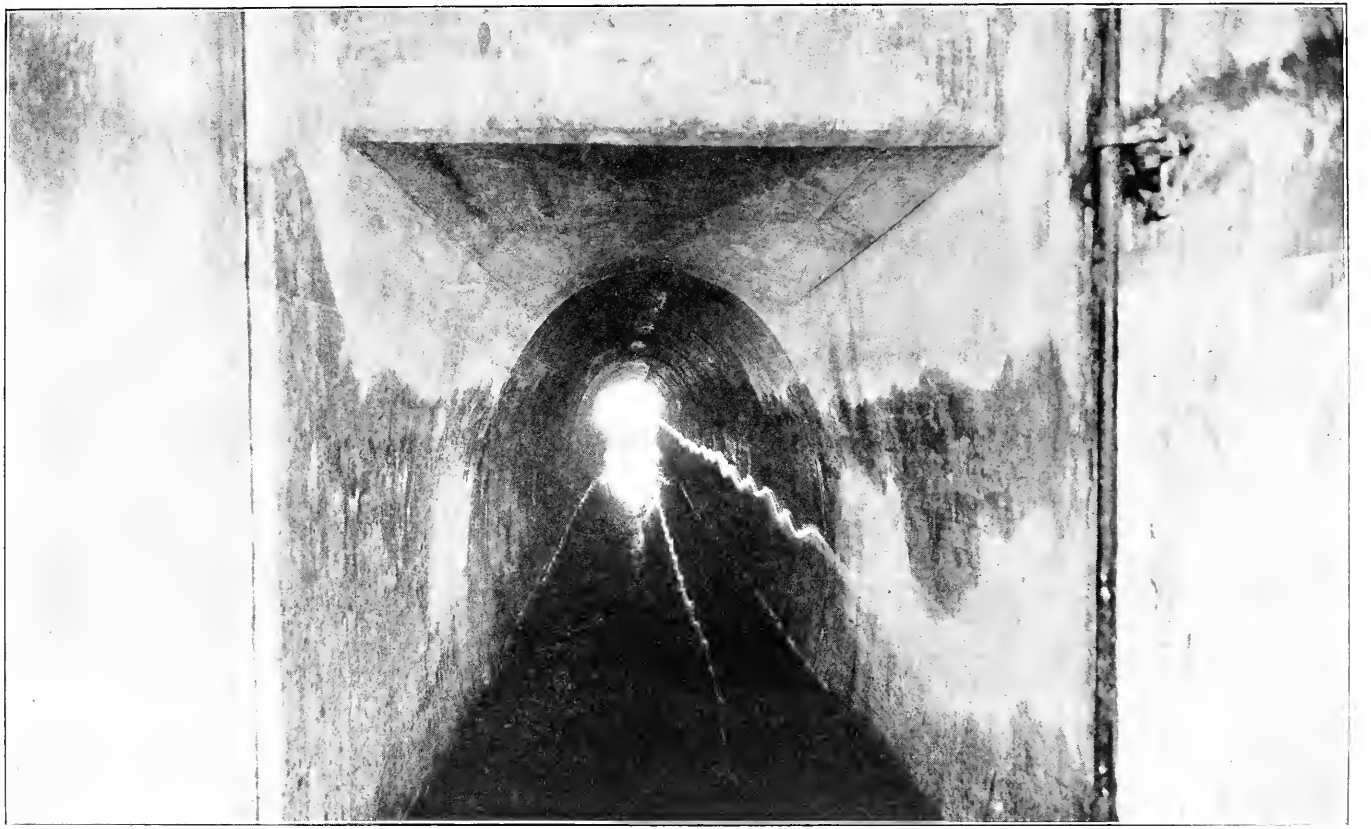
A part of the cost of the embankment is to be assessed upon the abutters in the form of betterments, and the Commission is keeping its accounts in such form that this assessment may be conveniently made soon after the completion of the work.

A Possible Subway under the Embankment.

The Commission had been advised of the possibility that the demand for the relief of the congestion of traffic on Boylston Street would result in the building of a subway to pass under the Boston Embankment. Accordingly, on April 3, 1906, it referred to the Boston Transit Commission the question as to the proper place for locating its marginal conduit so as to cause the least interference with the subway plan, in case the same were decided upon. Acting on the advice contained in a vote of the Boston Transit Commission at its meeting May 29, 1906, the Charles River Basin Commission laid out its marginal conduit, with the exception of the overflow chambers, a clear distance of about 30 feet from the existing wall of the



TEMPORARY BRIDGE.



BOSTON MARGINAL CONDUIT — OVERFLOW CONDUIT.

new embankment, and it is possible that the overflows can be reconstructed so that they will leave a clear distance of 30 feet.[1] Furthermore, the Commission provided, in its contracts for the embankment, for the possible diminution of the fill due to the construction of the subway.

V. The Craigie Temporary Bridge.

The Commission has continued, as in the year 1905, to maintain and operate the Craigie Temporary Bridge, which connects Leverett Street in Boston with Bridge Street in Cambridge. When the roadway of the Dam is completed, this bridge will be torn away and arrangements will be perfected for holding and maneuvering vessels while waiting for the opening of the Lock or of the draw in the railroad bridge below.

VI. The Marginal Conduits.

(*a*) *The Boston Marginal Conduit.*

Under Contract No. 1, the Holbrook, Cabot & Rollins Corporation drove, during January, February and March, foundation piles for Section 1 of the Boston Marginal Conduit, and work on the concrete masonry was started in July. This section is nearly completed.

Work on Section 2 of the Boston Marginal Conduit was in progress from a point some 250 feet south of Allen Street to the upper end of the section, at Cambridge Street. On the last day of December, 1905, pile-driving was completed, and the entire work on this section was completed Feb. 21, 1906.

The plans are ready for sections 3 and 4 of the conduit, and contracts for the remaining two sections will probably be let during 1907.

(*b*) *The Cambridge Marginal Conduit.*

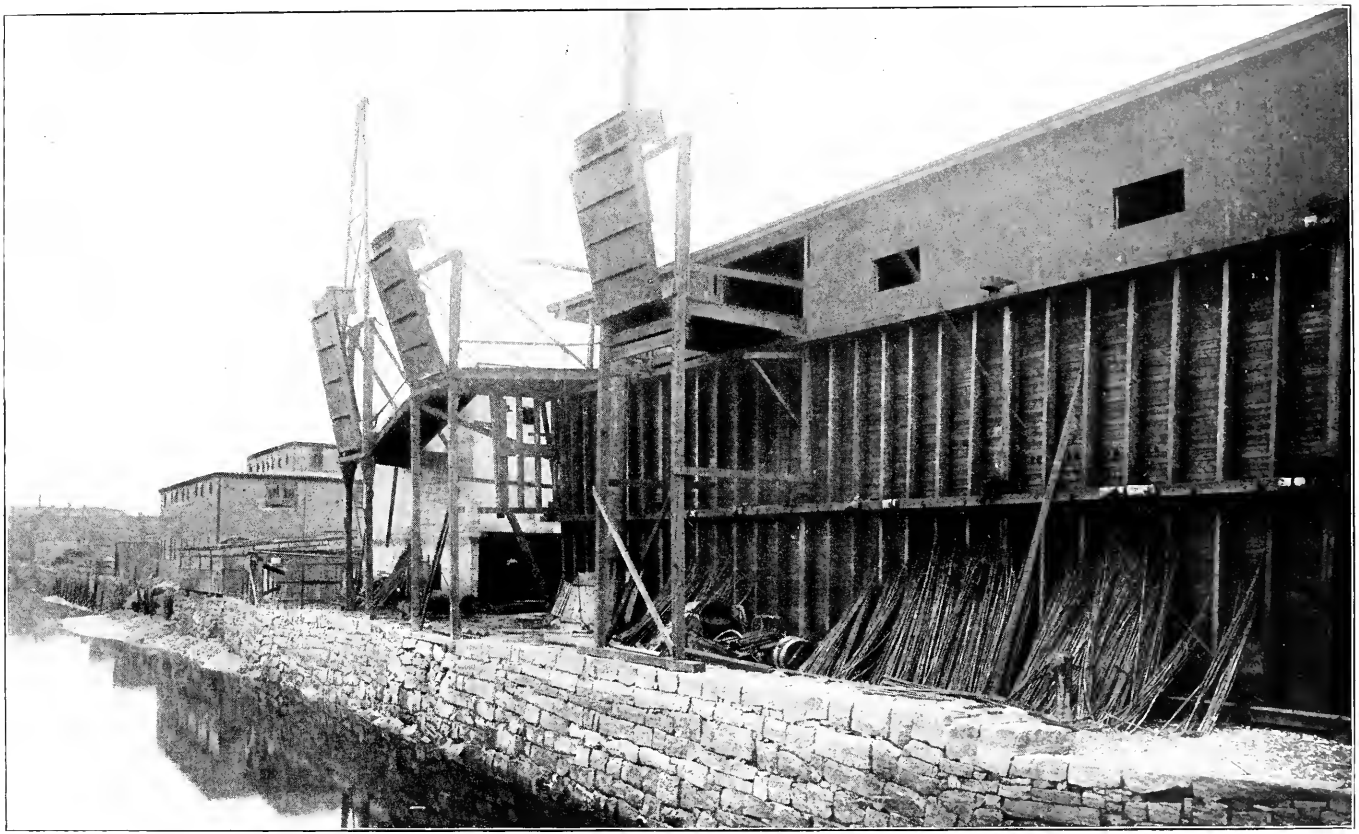
Studies have been in progress for the Cambridge Marginal Conduit, which is intended to intercept the Binney Street sewer overflow at the junction of Binney Street and Commercial Avenue, thence running along Commercial Avenue for some

[1] By a subsequent vote of the Boston Transit Commission, confirmed by a letter of its acting chairman dated April 12, 1907, the Commission was advised to locate the marginal conduit 39 feet from the present Basin wall, upon which revised location the Commission is proceeding to build the conduit.

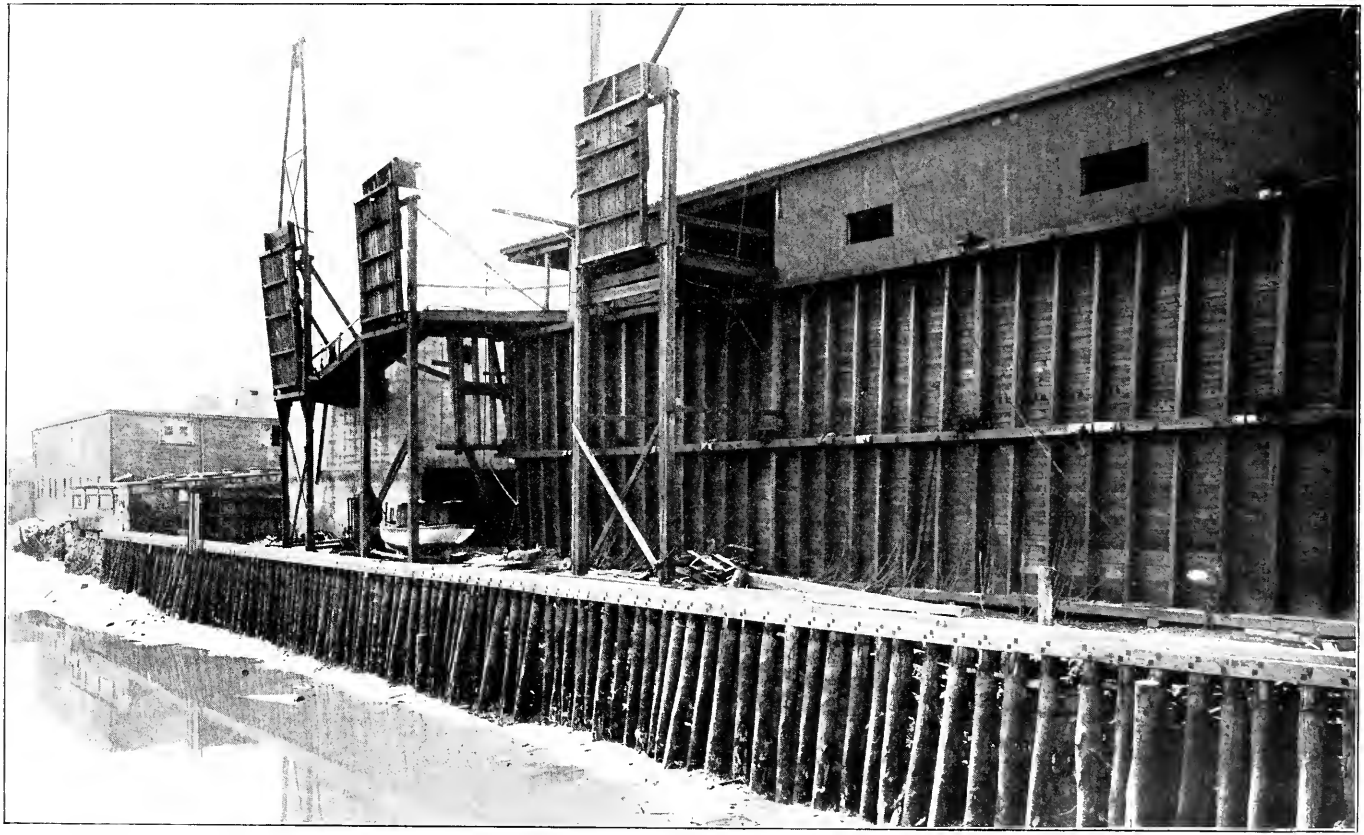
distance, turning into the park area belonging to the city of Cambridge, passing under the Lechmere Canal with an inverted siphon, and ending with an outlet into the westerly flood sluice at the Dam. A connection will also be made between the conduit and the Bridge Street sewer, so that storage in the two sewers in times of storms during the summer months can, if necessary, be equalized.

(c) Pollution.

When the Legislature of 1903 ordered the construction of the Boston Marginal Conduit, it was supposed that this conduit would take only sewage diluted with storm water in the times of sewer overflows, and the flow from the Stony Brook conduits, neither of which was supposed to be a sewer. From observation the Commission became convinced, early in the summer of 1906, that the Stony Brook conduits were in fact being used as sewers. Accordingly, the Commission requested Prof. Samuel C. Prescott to make careful investigations of the flow from these conduits which was coming into Charles River at Charlesgate East. The result of Professor Prescott's study and examinations, covering a period of six weeks, was to prove that a very strong solution of house sewage was flowing almost constantly from these conduits. The Commission called the attention of the city authorities to this condition, and forwarded Professor Prescott's report to the State Board of Health. Owing to the fact that the Stony Brook conduits will be connected with the Boston Marginal Conduit, the ordinary flow from these conduits will not go into the Basin; but if the city authorities allow the Stony Brook conduits to be used as sewers, they will be responsible for the creation of a nuisance at the outlet of the Boston Marginal Conduit, which will be just below the Dam. The city of Boston may, however, be compelled by the State Board of Health to abate any nuisance which is created in Charles River by the misuse of the Stony Brook conduits, on complaint of the mayor of a city or the selectmen of a town, under chapter 158 of the Acts of 1906.



BROAD CANAL — WALLS BEFORE DRIVING PILES



BROAD CANAL — WALLS AFTER DRIVING PILES.

VII. Dredging and Pile-driving in the Basin and in Broad and Lechmere Canals.

As advised by the Attorney-General, the Commission is not required by law to complete the work in the canals before the permanent Dam is completed; but, since it is the intention of the Commission to construct and operate a shut-off dam as soon as possible, consistent with convenience, economy and safety to the other work in its charge, the Commission has gone forward with the work of driving piles and of dredging, in both Broad and Lechmere canals. On Dec. 4, 1905, a contract was signed with Holbrook, Cabot & Rollins Corporation for the pile-driving in the canals. The dredging in the canals was provided for in Contract No. 1, for the Dam and Lock. Part of this dredging has been done during the year by the Eastern Dredging Company, who are subcontractors of the Holbrook, Cabot & Rollins Corporation.

On Dec. 30, 1905, pile-driving was begun in Broad Canal, in front of the property of the Rawson & Morrison Manufacturing Company on the southerly side. This work had progressed to such an extent that at the end of the year piles had been driven in front of all except parts of three properties on the northerly side of the canal.

In Lechmere Canal piles had been driven in front of about half the properties.

The dredging at the entrance to Broad Canal was begun on Aug. 25, 1906, and dredging in Broad Canal above First Street on September 4. This work was continued with some interruptions until the end of the year, at which time it was substantially completed from the entrance of the canal to a point about 400 feet below Third Street. The work from Third Street to Sixth Street, and beyond to the railroad and the property of the Geo. G. Page Box Company, will soon be started.

VIII. Approval of the War Department.

On application, the War Department transferred to the Commission, under date of Aug. 8, 1906, the license granted to the city of Boston to build the Boston Embankment, according to

plans submitted. The Department also issued to the Commission a permit to modify the cross-section of the embankment and the filling, to conform with plans worked out by the Commission under authority of chapter 402 of the Acts of 1906.

IX. Legislation of 1906.

The Legislature of 1906, pursuant to the recommendation of the Commission in its report for the year 1905, decided that the machinery of the drawbridges over the Lock and the machinery of the Lock and sluices should be under the same control. By chapter 368 of the Acts of 1906 the responsibility for the control of this machinery, as well as other matters relating to the care, maintenance and policing of the Dam and the Basin, was given to the Metropolitan Park Commission. Provision was also made, in section 3 of chapter 368 of the Acts of 1906, for the turning over of the Basin, the Dam, the Lock and all their appurtenances to the Metropolitan Park Commission by this Commission upon the completion of its work.

X. Takings of Property.

On Oct. 8, 1906, the Commission filed with the Suffolk Registry of Deeds a taking of such property rights as would be necessary to the construction of the Boston Embankment along the shore of the river from Cambridge Bridge to Charlesgate West.

After careful study of the situation and consultation with real estate experts, the Commission, on March 26, 1906, made an award of damages, under chapter 317 of the Acts of 1904, of $90,024.57 with interest, for taking the property of Mr. George O. Proctor for the Cambridge approach to the Dam. Mr. Proctor refused to accept the award as a settlement in full, and has filed a petition to recover additional damages.

XI. Litigation.

Petitions for damages against the Commonwealth on account of the Charles River Basin work, filed by Isaac Cohen *et al.*, by George O. Proctor and by Hazen E. Ricker *et al.*, are pending in the county of Middlesex.

XII. Contracts awarded.

(*a*) *Labor.*

Since the passage of chapter 517 of the Acts of 1906, the provision of law that no laborer, workman or mechanic on any of the Commission's work shall be required to work more than eight hours in any calendar day, has been made a part of all contracts.

(*b*) *List of Contracts.*

A detailed statement of the contracts awarded and pending during the year will be found in Appendix B, and is discussed in the Chief Engineer's report, annexed.

(*c*) *Sums held back from Contractors.*

The amounts reserved from sums due the contractors on monthly estimates, and not payable until after the completion of the contracts or until final settlement, are as follows: —

No. of Contract.	Name.	Work.	Amount.
1	Holbrook, Cabot & Rollins Corporation.	Dam and lock, ...	$60,000 00
2	United States Wood Preserving Company.	Wooden block paving for temporary bridge.	843 98[1]
23	Holbrook, Cabot & Rollins Corporation.	Piles along walls of canals and Basin.	7,692 00
24	American Bridge Company of New York.	Scherzer rolling lift bridge, . .	1,133 97
28	Coffin Valve Company, . . .	Tide-gates at the Dam and Lock, .	1,775 20
33	Chelmsford Foundry Company, .	Furnishing castings and other metal.	107 03
35	Gibby Foundry Company, . .	Furnishing castings and other metal.	396 65
44	Coleman Brothers, ...	Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment.	2,372 79
			$74,321 62

[1] Owing to the unsatisfactory condition of the work, an additional sum, amounting to $5,626.50, has been held back by the Commission.

XIII. Hearings.

During the year the Commission gave the following hearings: —

To Mr. Joseph Driscoll, representing James Driscoll & Son,

contractors for Section 2 of the Boston Marginal Conduit, relative to delay in their work, three hearings.

To Messrs. Alex. Reed and A. B. Clements, representing the United States Wood Preserving Company, and their engineer, Mr. B. T. Wheeler, relative to the failure of the paving furnished by the company for the temporary bridge, three hearings.

To Mr. Charles T. Chapin, representing the Consumers' Coal Company, and Mr. Ford (a wharf owner), relative to driving the piles in front of their wharf in Broad Canal.

To Messrs. Charles T. Chapin, representing the Consumers' Coal Company, and Horace A. Allyn, representing the Cambridge Gas Light Company, relative to arrangements for dredging in Broad Canal.

To Mr. A. L. Comstock, representing the American Rubber Company, in regard to work of dredging and driving piles in front of his company's property in Broad Canal.

To Messrs. Albert M. Barnes, William A. Hunnewell and J. Frank Wellington, committee of owners of wharves on Broad and Lechmere canals and on Charles River, and to Mr. Arthur H. Brooks, of counsel for the committee, relative to instruments releasing the Commonwealth from all claims for damages for work done under authority of chapter 465 of the Acts of 1903. The committee delivered releases signed by a majority of the wharf owners.

To Mr. Edward H. Baker, representing the Bay State Fuel Company, relative to the method and time of dredging in Broad Canal, two hearings.

To Mr. J. Frank Wellington, representing the Wellington-Wild Coal Company, in regard to dredging and driving piles in front of the company's wall on Lechmere Canal, two hearings.

To Mr. J. W. Rollins, Jr., representing the Holbrook, Cabot & Rollins Corporation, relative to the company's contracts Nos. 1 and 23, three hearings.

To Mr. John H. Gerrish, representing the Eastern Dredging Company, sub-contractor under contracts Nos. 1 and 23, relative to plans for a convenient arrangement with the wharf owners for dredging in Broad Canal.

To Mr. George O. Proctor, relative to taking of his land in

Cambridge and relative to his acceptance of the award of damages made by the Commission, three hearings.

To Mr. Hazen E. Ricker, representing E. Ricker, Son & Co., and his counsel, Mr. Paul R. Blackmur, relative to a claim for damages to E. Ricker, Son & Co. as lessees of a part of the Proctor property taken by the Commission, three hearings.

To Mr. Lucius Tuttle, representing the Boston & Maine Railroad, and General William A. Bancroft, representing the Boston Elevated Railway Company, relative to the laying of elevated railway tracks upon the Dam.

To Mr. Robert Winsor and General William A. Bancroft, representing the Boston Elevated Railway Company, relative to the Commission's objections to the proposed act for carrying an elevated railway structure across the Dam.

The Commission held a consultation with Chairman William B. de las Casas and Hon. Edwin U. Curtis, representing the Metropolitan Park Commission, and Mr. John R. Rablin, Chief Engineer of that Commission, relative to buildings to be erected on the Dam, and other matters affecting the maintenance of the Dam and Basin after the completion of the same.

XIV. Issue of Bonds.

On Jan. 10, 1906, the Commission voted to advise the Treasurer of the Commonwealth to make available additional funds to the amount of $600,000 for the year 1906. Bonds to the amount above named were issued under the title of the "Charles River Basin Loan," and $515,000 were sold. The remaining $85,000 were held by the Treasurer at the end of the fiscal year. The total issue of bonds on account of the Charles River Basin Loan to Dec. 1, 1906, is $1,165,000.

XV. Payments to the Sinking Fund.

Payments to the sinking fund during the year amounted to $26,421. The total payments to the sinking fund to Dec. 1, 1906, amount to $65,112.80.

XVI. Reports issued by the Commission.

Fifteen hundred reports were printed, at a cost of $659.01. Of this number the Commission was allowed 350 copies to meet the demands of officials and citizens of the 38 cities and towns which are to pay for the Charles River Basin work. The supply fell far short of the demand.

XVII. Statement of Expenditures and Receipts.

The following statement of expenditures and receipts was filed on Jan. 16, 1907: —

Expenditures.

The total amount of expenditures from Oct. 1, 1905, to Nov. 30, 1906, is $683,566.09. The total amount from July 29, 1903, the date of the organization of the Commission, to Nov. 30, 1906, is $946,638.23.

The general character of these expenditures is as follows: —

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).		From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).	
Administration.				
Commissioners,	$11,666 67		$33,024 69	
Secretary,	3,100 00		5,483 33	
Clerks and stenographers,	1,106 00		2,242 84	
Legal services,	8 00		8 00	
Traveling,	85 54		293 73	
Stationery and printing,	916 41		1,764 82	
Postage, express and telegrams,	48 58		101 54	
Furniture and fixtures,	131 90		444 01	
Alterations and repairs of building,	–		123 10	
Telephone and lighting,	104 38		244 79	
Rent,	333 34		1,053 58	
Miscellaneous expenses,	57 05		149 57	
		$17,557 87		$44,934 00
Engineering.				
Chief, principal assistant and division engineers,	$12,736 11		$33,330 35	
Engineering assistants,	32,334 24		59,310 23	
Consulting engineers,	1,237 50		6,538 40	
Inspectors,	16,819 49		19,937 95	
Architect,	512 72		1,094 72	
Traveling,	448 49		812 04	
Wagon hire,	2 00		60 50	
Stationery and printing,	1,149 50		2,804 17	
Postage, express and telegrams,	65 20		145 29	
Instruments and tools,	1,567 73		4,299 59	
Engineering and drafting supplies,	633 95		1,166 67	
Books, maps and photographs,	1,134 96		1,749 44	
Furniture and fixtures,	432 71		2,321 70	
Alterations and repairs of building: —				
Main office,	–		1,092 14	
Sub-offices,	107 37		321 43	
Telephone and lighting, main office,	282 66		610 54	
Amounts carried forward,	$69,414 63	$17,557 87	$135,595 16	$44,934 00

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).		From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).	
Amounts brought forward,	$69,414 63	$17,557 87	$135,595 16	$44,934 00
Engineering — Con.				
Telephone, lighting, heating and care of building, sub offices,	361 29		556 17	
Rent, main office,	2,000 04		5,446 51	
Rent of field office,	-		251 45	
Unclassified supplies,	87 40		153 34	
Miscellaneous expenses,	114 07		209 10	
		71,977 43		142,211 73
Construction — Preliminary.				
Advertising,	$455 70		$775 19	
Labor,	212 48		5,213 42	
Traveling,	-		19 08	
Water rates,	-		3 45	
Freight and express,	10 00		61 17	
Jobbing and repairing,	-		35 68	
Tools, machinery, appliances and hardware supplies,	25 00		210 76	
Castings, ironwork and metals,	16 55		218 09	
Iron pipe and valves,	-		98 96	
Fuel, oil and waste,	-		62 65	
Lumber,	-		338 08	
Cement,	-		24 75	
Sand,	-		3 00	
Unclassified supplies,	-		14 69	
Miscellaneous expenses,	35 32		391 16	
		755 05		7,470 13
Construction — Contracts.				
Contracts completed and final payments made prior to Oct. 1, 1905,	-		$21,053 69	
Contract No. 1, Holbrook, Cabot & Rollins Corporation,	$306,779 71		408,709 83	
Contract No. 2, United States Wood Preserving Co.,	-		4,782 52	
Contract No. 3, James Driscoll & Son,	39,410 66		52,383 10	
Contract No. 4, Camden Iron Works,	5,833 86		5,833 86	
Contract No. 5, Henry R. Worthington,	2,859 90		2,859 90	
Contract No. 6, Gibby Foundry Co.,	6,262 48		6,262 48	
Contract No. 13, Aberthaw Construction Co.,	773 92		5,388 72	
Contract No. 14, Gibby Foundry Co.,	736 80		736 80	
Contract No. 15, Coffin Valve Co.,	1,801 54		1,803 89	
Contract No. 16, The Boston Bridge Works,	1,308 67		1,308 67	
Contract No. 17, The Lumsden & Van Stone Co.,	3,975 75		3,975 75	
Contract No. 18, The Ludlow Valve Manufacturing Co.,	861 95		861 95	
Contract No. 19, The Scherzer Rolling Lift Bridge Co.,	3,500 00		3,500 00	
Contract No. 20, Geo. McQuesten Co.,	3,394 69		3,394 69	
Contract No. 21, E. D. Sawyer Lumber Co.,	1,033 76		1,033 76	
Contract No. 22, Gow & Palmer,	1,681 03		1,681 03	
Contract No. 23, Holbrook, Cabot & Rollins Corporation,	43,587 98		43,587 98	
Contract No. 24, American Bridge Company of New York,	2,026 19		2,026 19	
Contract No. 26, E. Gerry Emmons Corporation,	525 00		525 00	
Contract No. 28, Coffin Valve Co.,	2,662 80		2,662 80	
Contract No. 29, Aberthaw Construction Co.,	3,461 66		3,461 66	
Contract No. 31, The William Cramp & Sons Ship & Engine Building Co.,	1,929 60		1,929 60	
Contract No. 32, Geo. W. Gale Lumber Co.,	3,479 10		3,479 10	
Contract No. 33, Chelmsford Foundry Co.,	606 47		606 47	
Contract No. 34, Geo. McQuesten Co.,	54 15		54 15	
Contract No. 35, Gibby Foundry Co.,	2,247 67		2,247 67	
Contract No. 36, Fred A. Houdlette & Son,	682 81		682 81	
Contract No. 39, H. W. Hayes & Co.,	944 20		944 20	
Contract No. 42, New England Structural Co.,	4,557 00		4,557 00	
Contract No. 44, Coleman Bros.,	13,445 78		13,445 78	
Contract No. 52, Aberthaw Construction Co.,	225 31		225 31	
		460,650 44		606,006 36
Amounts carried forward,		$550,940 79		$800,622 22

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).		From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).	
Amounts brought forward,		$550,940 79		$800,622 22
Construction — Additional.				
Labor,	$26,944 13		$31,338 87	
Professional services,	202 00		202 00	
Traveling,	–		86	
Freight and express,	119 57		123 87	
Jobbing and repairing,	449 79		622 76	
Tools, machinery, appliances and hardware supplies,	1,577 99		6,273 65	
Castings, ironwork and metals,	2,115 58		2,311 91	
Iron pipe and valves,	2,293 90		2,300 81	
Paint and coating,	28 46		35 46	
Fuel, oil and waste,	402 83		441 36	
Lumber and field buildings,	1,290 21		4,379 12	
Cement and stone,	2 05		6 05	
Sand,	36 00		40 00	
Municipal and corporation work,	589 00		855 97	
Unclassified supplies,	68 53		257 49	
Miscellaneous expenses,	1,596 34		1,757 22	
		37,716 38		50,947 40
Real Estate.				
Legal and expert,	$173 06		$332 75	
Payment *pro tanto* under chapter 317, Acts of 1904,	94,735 86		94,735 86	
		94,908 92		95,068 61
Totals,		$683,566 09		$946,638 23

The foregoing expenditures have been distributed among the various objects or works as follows: —

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).	From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).
Administration, applicable to all parts of the work,	$17,557 87	$44,934 00
Dam,	205,105 71	244,120 50
Lock,	234,231 74	303,760 42
Temporary bridge and approaches,	34,573 44	112,443 09
Drawbridge,	24,218 47	33,078 03
Highway,	49 00	109 92
Dredging and pile-driving in Basin,	19,368 03	20,042 94
Broad Canal,	41,878 14	44,839 26
Lechmere Canal,	7,173 68	8,711 58
Boston Embankment,	23,800 11	23,800 11
Boston Marginal Conduit,	74,559 41	108,818 14
Cambridge Marginal Conduit,	1,050 49	1,980 24
Totals,	$683,566 09	$946,638 23

Receipts.

The total amount of receipts from Oct. 1, 1905, to Nov. 30, 1906, is $1,478.33, which sum represents also the total receipts from July 29, 1903, the date of the organization of the Commission, to Nov. 30, 1906. The receipts were mostly from

rents of the Proctor property in East Cambridge, and from sale of old lumber from the temporary bridge.

The general character of these receipts is as follows: —

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).	From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).
To the Credit of the Loan Fund.		
Supplies,	$63 00	$63 00
To the Credit of the Sinking Fund.		
Rents,	1,415 33	1,415 33
Totals,	$1,478 33	$1,478 33

The foregoing receipts have been credited to the various objects or works as follows: —

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).	From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).
Dam,	$1,416 83	$1,416 83
Lock,	1 50	1 50
Temporary Bridge and approaches,	59 00	59 00
Boston Marginal Conduit,	1 00	1 00
Totals,	$1,478 33	$1,478 33

The report of the Chief Engineer follows.

In Appendix A will be found chapter 465 of the Acts of 1903, as amended by chapter 65 of the Acts of 1905 and chapters 368 and 402 of the Acts of 1906, together with chapter 107 of the Resolves of 1904 and chapter 158 of the Acts of 1906, being all the other acts relating to the Charles River Basin work.

The Commission desires to report a busy year of work and one of satisfactory progress. The problem of the Commission has been changed and made much more complex by having added to its work the construction of the embankment along the back of Brimmer Street and Beacon Street. All these de-

tails, however, have been taken up and pushed with as great rapidity as the circumstances would admit, for which the Commission is indebted to the efficiency and energy of its various officials and employees.

Respectfully submitted,

HENRY S. PRITCHETT,
HENRY D. YERXA,
JOSHUA B. HOLDEN,
Charles River Basin Commission.

BOSTON, Jan. 17, 1907.

REPORT OF THE CHIEF ENGINEER.

To the Charles River Basin Commission.

Gentlemen: — The following is a report of the work of the engineering department for the fourteen months ending Nov. 30, 1906.

Organization.

Mr. Frank E. Winsor continued as principal assistant engineer until April 10, 1906, when he resigned to accept a better position with the Board of Water Supply of New York City.

Mr. John L. Howard continued as division engineer, in charge of field work.

Upon the resignation of Mr. Winsor, Mr. Edward C. Sherman, assistant engineer, was promoted to the position of division engineer, in charge of designing, drafting and other office work.

Mr. Frederic P. Stearns continued to act as consulting engineer.

Mr. Guy Lowell was consulted in architecture and landscape architecture.

Mr. John R. Worcester was consulted in regard to structural steel work.

Mr. Staunton B. Peck, of Chicago, Ill., was consulted in regard to the operating machinery of the rolling Lock-gates.

Mr. F. W. Dean, of Dean & Main, was consulted in regard to the boiler plant required at the Dam.

The engineering force at the beginning of the year numbered 35, and was increased from time to time as the work required, until at the end of the year it numbered 69.

The names of the assistants in the engineering department, not mentioned above, who have been employed for not less than one month, are given below, with the positions last held, together with an indication of the work performed by them: —

Assistant Engineers.

John N. Ferguson,	In charge of work on the canals under Contract No. 23, and for the Boston Embankment and Boston Marginal Conduit under Contracts Nos. 3, 44 and 50; also in charge of the measurements of the flow of the river at Waltham and of the inspection of the sewer overflows into the Basin between Craigie Bridge and Cottage Farm.
J. Albert Holmes,	In general charge of work under Contract No. 1, for the Dam and Lock.
George E. Russell,	Designs and estimates for masonry and for the Boston Embankment.
Walter R. Kattelle,	Designs, studies and estimates for masonry and structural steel work.
William C. Pickersgill,	Designs and studies for masonry.
Wilbur T. Wilson,	Designs and studies for masonry and structural steel work.
Leonard P. Wood,	Designs and studies for masonry and steel reenforcement.
Robert E. Barrett,	Designs for masonry and miscellaneous office work.
Herbert W. Olmsted,	In charge of work at the sluices of the Dam.
Morton F. Sanborn,	In charge of work in the Cambridge canals and on the Boston Marginal Conduit.
Walter E. Wheeler,	In charge of work at the Lock.

Mechanical Engineer.

Walton H. Sears,	Designs for Lock-gate operating machinery, steam boilers, steam and air piping, and miscellaneous office work.

Instrumentmen, Draftsmen, etc.

Arthur L. Bridgham,	Instrumentman.
James E. Barlow,	Instrumentman.
Robert E. Wise,	Instrumentman.
Frederic C. H. Eichorn,	Instrumentman.
Milton J. Adams,	Instrumentman.
Frank V. Andrews,	Instrumentman.
Bertram I. Hall,	Instrumentman.

Norman C. McNeil,	Instrumentman.
John M. O'Donoghue,	Instrumentman.
Arthur E. Tarbell,	Instrumentman.
Dow H. Nicholson,	Instrumentman.
Joseph M. Story,	Instrumentman.
Charles C. Carroll,	Draftsman.
Herbert W. Harvey,	Draftsman.
Albert J. Holmes,	Draftsman.
Burtis S. Brown,	Rodman.
Thomas J. Long,	Rodman.
Frank A. McDonald,	Rodman.
Edward S. Brown,	Rodman.
Ralph W. Emerson,	Rodman.
Everett H. Fernald,	Rodman.
Charles S. Gordon,	Rodman.
Timothy Guiney,	Rodman.
Harry C. Hatch,	Rodman.
James Hayes, Jr.,	Rodman.
Daniel P. Kelley,	Rodman.
Ernest E. Lothrop,	Rodman.
William J. Lumbert,	Rodman.
William A. G. Moffatt,	Rodman.
Alphonsus O'Farrell,	Rodman.
Horace C. Sawyer,	Rodman.
William T. Shaw,	Rodman.
Arthur E. Spencer,	Rodman.
Frederick J. Welch,	Rodman.
John F. Callahan, Jr.,	Rodman.
Charles J. O'Donnell,	Rodman.
Matthew W. Horgan,	Rodman.
Herbert O. Welsch,	Rodman.
James McKnight,	Rodman.
Robert L. Smith,	Rodman.
Frederick A. Cole,	Rodman.
Edward T. O'Keefe,	Rodman.

Inspectors.

Arthur I. Plaisted,	Engineering inspector, — on all metal work at Lock and all electrical appliances.
Walter N. Charles,	Engineering inspector, — on pile-driving and office work for estimates.
Charles E. Baker, Jr.,	Engineering inspector, — on dredging.
Henry M. McCue,	Engineering inspector, — on dredging.
Franklin L. Mason,	Inspector, — on Lock and Boston Marginal Conduit masonry.

John P. McKnight,	Inspector, — on Lock and sluice masonry.
Samuel B. Horton,	Inspector, — on pile-driving.
Robert P. O'Keefe,	Inspector, — on Lock and sluice masonry.
Samuel Taylor,	Inspector, — on pile-driving.
Thomas L. Whelan,	Inspector, — on masonry and pile-driving.
Walter A. Livermore,	Inspector, — on pile-driving and setting metal at sluices.
George O. Souci,	Inspector, — on pile-driving.
Daniel J. Sullivan,	Inspector, — on paving and pile-driving.
George L. Bosworth,	Assistant inspector.
Bernard E. Grant,	Assistant inspector.

Stenographers and Clerks.

Jennie L. Rawson,	Stenographer and clerk, — administrative work, accounts and letters.
Mabel F. Paton,	Stenographer and clerk.
Edith F. White,	Stenographer and clerk.
Ethelyn B. Marlatte,	Stenographer and clerk.
Hortense de Coen,	Stenographer.
Alfred Wm. Treen,	Clerk and messenger.

In addition to the above regular employees, Mr. Herbert L. Sherman, 220 Devonshire Street, Boston, continued to have charge of the cement testing; Mr. William R. Conard, of Burlington, N. J., continued in charge of inspection of pipes and specials manufactured in that locality; Stowell & Cunningham, of Albany, N. Y., were employed as inspectors of mill and shop work on structural steel for the drawbridge and Lock-gates and other structural material; Prof. C. E. Fuller, of the mechanical engineering department of the Massachusetts Institute of Technology, made physical tests on twisted steel rods, cast steel, bronze and other metals; and Mr. Squire Howarth, 7 Regent Square, Roxbury, an expert machinist, inspected material being made at various foundries and machine shops.

The principal engineering office was continued at 367 Boylston Street, Boston; an office for the field force was continued at 12 Bridge Street, East Cambridge; and on Nov. 5, 1906, another office for the field force was established at 108 Chestnut Street, Boston.

Dam and Lock.

A large part of the time of the office force was devoted to the preparation of the necessary working drawings for Contract No. 1 for the Dam and Lock, as the contract plans for this work were general in character, the final study of a great many of the details being left for further attention. Some one hundred drawings, showing details of concrete and granite masonry, pile foundations, and steel reenforcement of concrete, were made in connection with this work.

The condition of the work on the Dam and Lock at the end of the period covered by this report was as follows: —

The concrete masonry of the Lock structure was substantially completed, and the granolithic surface on top of the Lock walls was finished from the upper end of the Lock to within 30 feet of the lower gate recess. All of the bollards and sheaves and the anchor bolts for the two capstans were in place. The bed-plates for some of the machinery for operating the Lock-gates had been set. The pump-wells were finished and ready to have the pumps set up. The steel work for the Scherzer rolling lift bridge was being delivered, and the track girders to support the same had been set in place.

At the sluices, substantially all of the concrete below the floor of the gate-chambers was completed, some 3,500 cubic yards of concrete having been placed, leaving 500 or 600 cubic yards required to finish the work, and about one-half of the steel work for the gate chambers was in place. The greater part of the stone masonry for the face walls of the sluices was on hand, and rather more than one-half of it had been set.

Coffer-dam at the Boston Side of the River.

At the close of the period included in the last annual report, the sheeting for the Boston coffer-dam being constructed by the Holbrook, Cabot & Rollins Corporation under Contract No. 1 had all been driven, but there still remained some bracing and considerable filling to be done before pumping out the coffer-dam. Prior to starting the pump, the sluice-gates were closed at low water and maintained in that condition until the next low

water, during which time the water surface inside the coffer-dam rose 0.65 of a foot under a maximum head of about 8 feet. This would equal a leakage of about 2.6 cubic feet per second. The coffer-dam (which was described in the report for the year ending Sept. 30, 1905) is about 600 feet long by about 250 feet wide, and contains some 4 acres. In order to prevent any sliding or movement of the banks of the coffer-dam, caused by lowering the water surface too rapidly, the water was lowered gradually, as shown by the following table: —

Elevations of Water in Coffer-dam as Pumping out progressed.

At start, October 11,	102.0	October 21,[1]	79.7
October 12,	94.7	October 24,	77.3
October 13,	90.0	October 27,	73.3
October 15,	88.0	October 28,	70.0
October 16,	87.3	October 30,	67.5
October 17,	85.0	October 31,	66.5
October 18,	83.0	November 1,	65.0
October 19,	80.0		

The pumping out of the coffer-dam was done by a 15-inch direct-connected centrifugal pump built by the Lawrence Machine Company, and steam was supplied from a 150 horse-power boiler with steam at 100 pounds pressure. After the coffer-dam was pumped out, several leaks around the sluice-gates were calked, and since that time the pumping has been quite uniform and constant, the 6-inch pump running from 48 to 50 hours a week, or the 15-inch pump running from 16 to 20 hours a week, taking care of the leakage under ordinary conditions. The boiler was supported on a pile foundation built just outside the line of the Lock and adjacent to the proposed location of the pump-well. The 15-inch pump was mounted on a pontoon, and the discharge was through sections of 24-inch spiral riveted galvanized-iron pipe about 2 feet in length. As the water lowered, additional sections were added to the discharge pipe until the pontoon grounded. The steam connection was through a flexible hose 4 inches in diameter, similar to those used for connections with steam drills. As soon as the water was pumped out, ditches were dug to conduct the water to the pump-well, which was immediately started. The pump-well was 15 feet square at

[1] Began excavating.

top and 11 feet square at bottom, built of 6-inch splined sheeting, and was carried down to elevation 63.0, nearly 10 feet below the bottom of the concrete in the main portion of the Lock, which is to be at elevation 72.6.

Earth excavation was continued from time to time in advance of the pile-driving and placing of masonry, as was convenient and desirable for the Contractor.

Foundations for the Lock.

Before the pumping out was entirely completed, a pile-driver was set up by the Holbrook, Cabot & Rollins Corporation, the contractor under Contract No. 1, on blocking in the bottom of the excavation for the Lock, to drive piles for a trestle from which the foundation piles for the bottom of the Lock could be driven. This pile-driver was built with an overhang of 16 feet, so that piles could be driven in bents 14 feet in advance, on which timbers were laid, forming a platform upon which a second pile-driver with extension gins was operated to fill in the piles between the 14-foot bents.

Pile-driving was continued all through the winter, except for occasional stormy days, so that by the time the weather was warm enough to lay concrete nearly one-half of the entire number of piles had been driven. As the material through which the piles were being driven changed continually, it was thought advisable to have some additional borings made for the purpose of obtaining more accurate information in regard to the underlying strata than was obtained by those previously taken at greater intervals. An agreement was therefore made with Gow & Palmer on Nov. 6, 1905, for making additional borings, as required, at a price of $0.65 per linear foot. Under this agreement 54 borings were made under the Lock to a total depth of 1,776.8 feet, and 29 borings were made under the sluices to a total depth of 809.4 feet.

Under the toe of the side walls of the Lock the piles were spaced 2 feet 6 inches on centers, in rows 21 inches apart, the piles in the adjacent rows being staggered. It was anticipated that this close spacing might compact the earth so that it would be difficult to drive the piles, but no trouble of this nature was found. On starting work, the piles under the front of the wall

were driven first; but it was soon noticed that as the piles in the rear rows were being driven, the piles under the front part were being pushed out towards the center of the Lock, in some places the movement being as much as 1½ feet. Afterwards the back row was driven first, and from that time on no further movement of the piles towards the center of the Lock was observed.

It was also noted in driving the piles that in some places the piles would rise from 3 to 4 inches after being driven, as the earth was compacted around them by the driving of the adjacent piles. Observations were taken on one set of four piles, to determine the amount and duration of this movement, and to see if the rising of the piles left them less firmly fixed in place; but the penetration on redriving was found practically identical with that on the original driving.

At the upper end of the Lock and under the upper gate recess a very firm and hard bottom was found, composed of clay and gravel, and in one place of a very fine sand and gravel mixed with a little clay, through which it would have been impossible to drive spruce piles; and, as the borings showed rock at a distance of from 6 to 10 feet lower, tests were made to see if there would be any settlement under the anticipated loads. A 12-inch cube of long-leaf yellow pine was placed on a carefully leveled space, and on top of this cube was placed a casting weighing 4 tons. Daily elevations were then taken on this casting for a period of two weeks, during which time it remained practically stationary and showed no sign of settlement. It was then decided to place the upper end of the Lock directly on the hard bottom, except on the westerly side of the Lock, where piles were driven 8 feet and up in length.

A pile near the lower end of the Lock was tested by the use of some 15 tons of pig lead loaded on a platform built on the top of a pile, with the following results: —

Pile loaded,	Jan. 25.
Settlement observed,	" 27, .015 foot.
Total settlement observed,	Feb. 3, .024 foot.
Total settlement observed,	" 10, .024 foot.
Total settlement observed,	" 17, .024 foot.
Total settlement observed,	" 19,[1] .024 foot.

[1] Test abandoned.

It was thought that this slight change was probably due to the compression of the fibers, and that the pile would safely support a load of 15 tons without movement.

Two lines of 6-inch spruce or yellow pine sheeting were driven underneath the Lock, to prevent the passage of water along the bottom of the concrete, one under the lower gate recess and across the Lock opposite same, and one about half way up the Lock, to be connected later with the shut-off dam on the westerly side of the Lock. A third line of cut-off sheeting was also shown on the contract plans under the upper gate recess; but the bottom was so hard at this point that the sheeting, as well as the foundation piles, was omitted, except the foundation piles under the westerly side wall.

Concrete Masonry at the Lock.

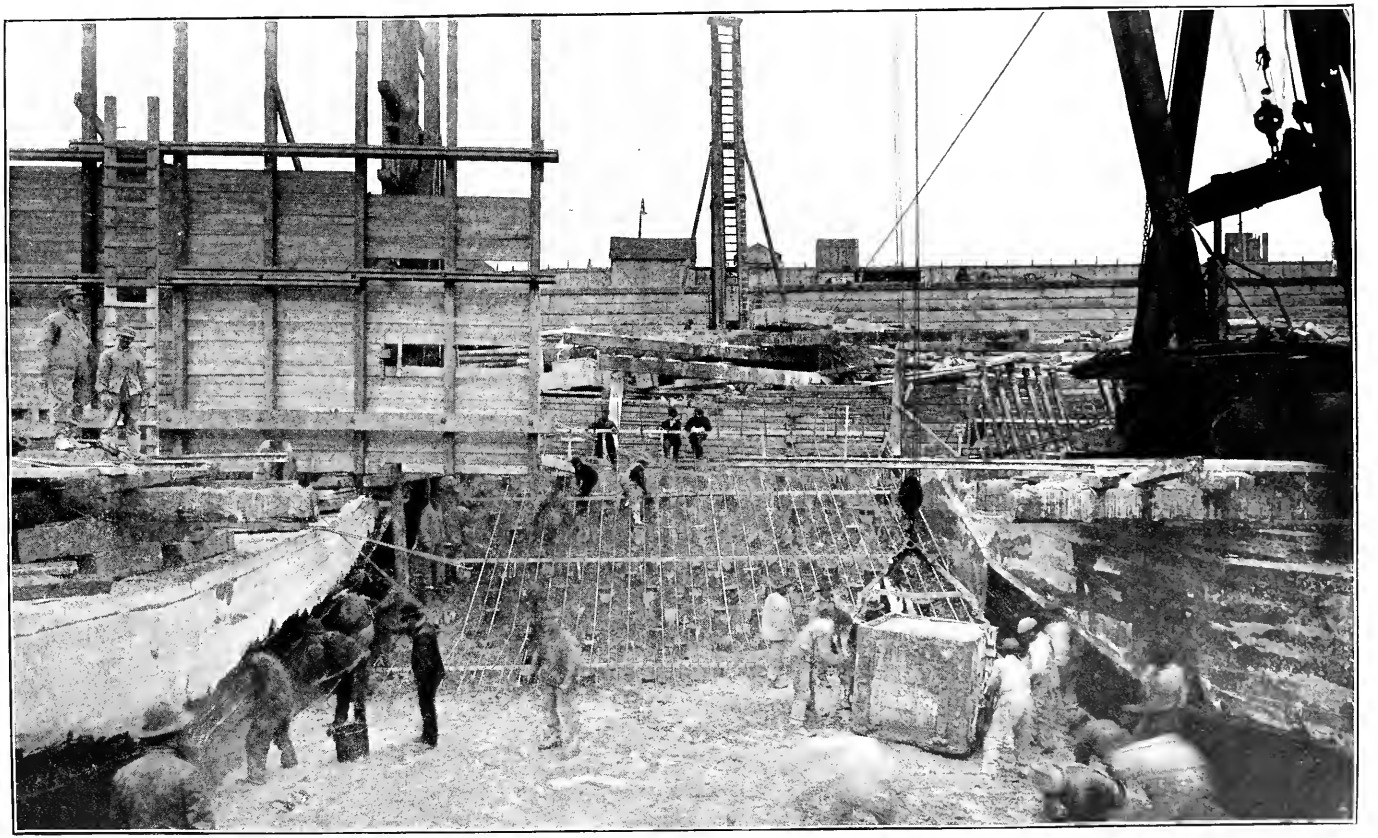
This work is included in Contract No. 1, with the Holbrook, Cabot & Rollins Corporation. Gravel from the harbor and from Shirley Gut was brought up by scows and dumped in the river bed at the lower end of the coffer-dam. From there it was raised by a rehandler operating an orange peel bucket to an elevated hopper 16 feet by 14 feet, with its top about 70 feet above the bottom of the Lock. From this hopper the material passed over four screens set at an angle of 1 to 12, which separated the material into the sand and stones, which were deposited in storage bins of 120 and 200 cubic yards capacity. Below the storage bins were the measuring hoppers for getting the proper quantity of sand and gravel. After leaving the measuring hoppers, the sand and gravel passed to a 24-inch belt conveyor about 90 feet long, which carried the mixture, together with the proper amount of cement, to a hopper directly over a cubical mixer holding a little over 2 cubic yards. From the cubical mixer the concrete was dumped into boxes holding about 2 cubic yards, mounted on trucks running on a track and operated by an endless cable. The boxes were of the bottom-dumping type, the doors automatically locking when replaced empty upon the car trucks.

The concrete boxes were handled by a movable bull-wheel derrick mounted on a platform at the elevation of the top of the Lock walls, and carried on wheels running on rails laid on

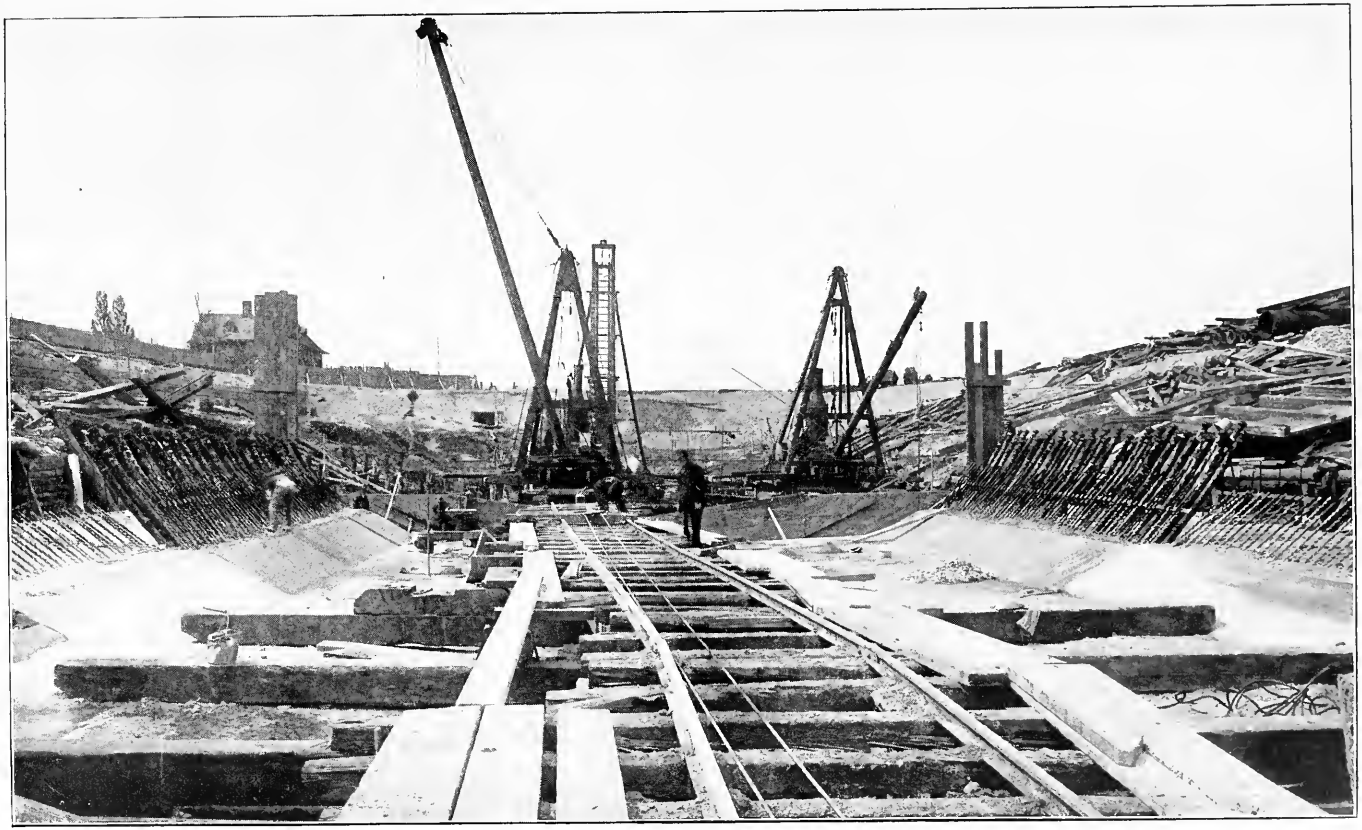
heavy timbers on each side of the bottom of the Lock. The forms for the side walls of the Lock were 40 feet long and about 30 feet high, and were built of 3-inch plank planed one side to even thicknesses. These side wall forms were hung from a traveler 30 feet high and 40 feet long, running in advance of the movable derrick on the same rails, and were placed in position by means of jacks and other bracing, as the case required.

The specifications provided that the Lock should be built in sections not exceeding 40 feet in length, and the ends of the sections were to have an offset or projection 6 inches in width, to form a water-stop. The ends of these sections were covered with two layers of tar paper applied with a hot mixture of coal-tar pitch, which was first spread over the surface of the concrete, then between the layers of tar paper, and finally over the entire surface of the tar paper joint.

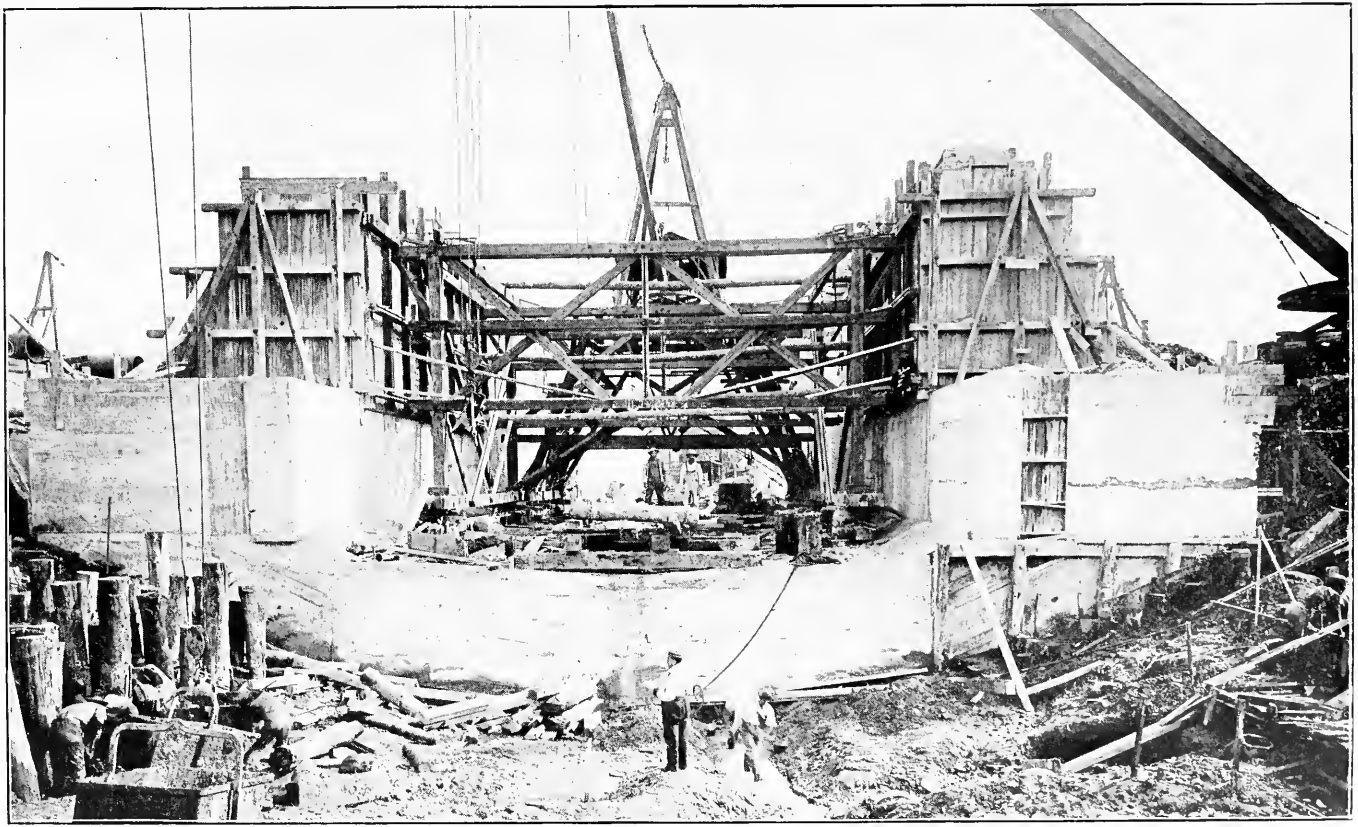
The sequence of operations in concreting one section of the Lock was as follows: first, the excavation was completed to the proper grade; then the piles were cut off and the bottom set of twisted steel rods, ¾ of an inch in diameter and 11 inches on centers, was placed in position; then the concrete mixed in the proportion of 1 : 3 : 6 was brought up in level layers about 1 foot thick to within a foot of the top of the bottom of the Lock; then the top set of 1⅛-inch diameter twisted steel rods, 8 inches on centers, was placed 6 inches below the finished surface, and the top 12 inches of 1 : 2½ : 5 concrete brought to the finished surface; then the forms for the slope at the foot of the side walls, rising 2 feet vertically in 3½ feet horizontal, were set and the concrete brought up to the top of the slope. After this concrete was set, the high side wall forms, 40 feet long by 30 feet high, were set and braced in position, after which the side walls were brought up in horizontal layers, care being taken to keep the opposite sides at about the same elevation. It required some ten days to complete a 40-foot section of side walls after the bottom section was put in, and some two days more to move the high forms ahead and set them in position for the next section. The question of the proper mixture and thickness to use for the facing of the side walls of the Lock required considerable attention, and a series of experiments was made to determine what proportions made the most impermeable concrete.



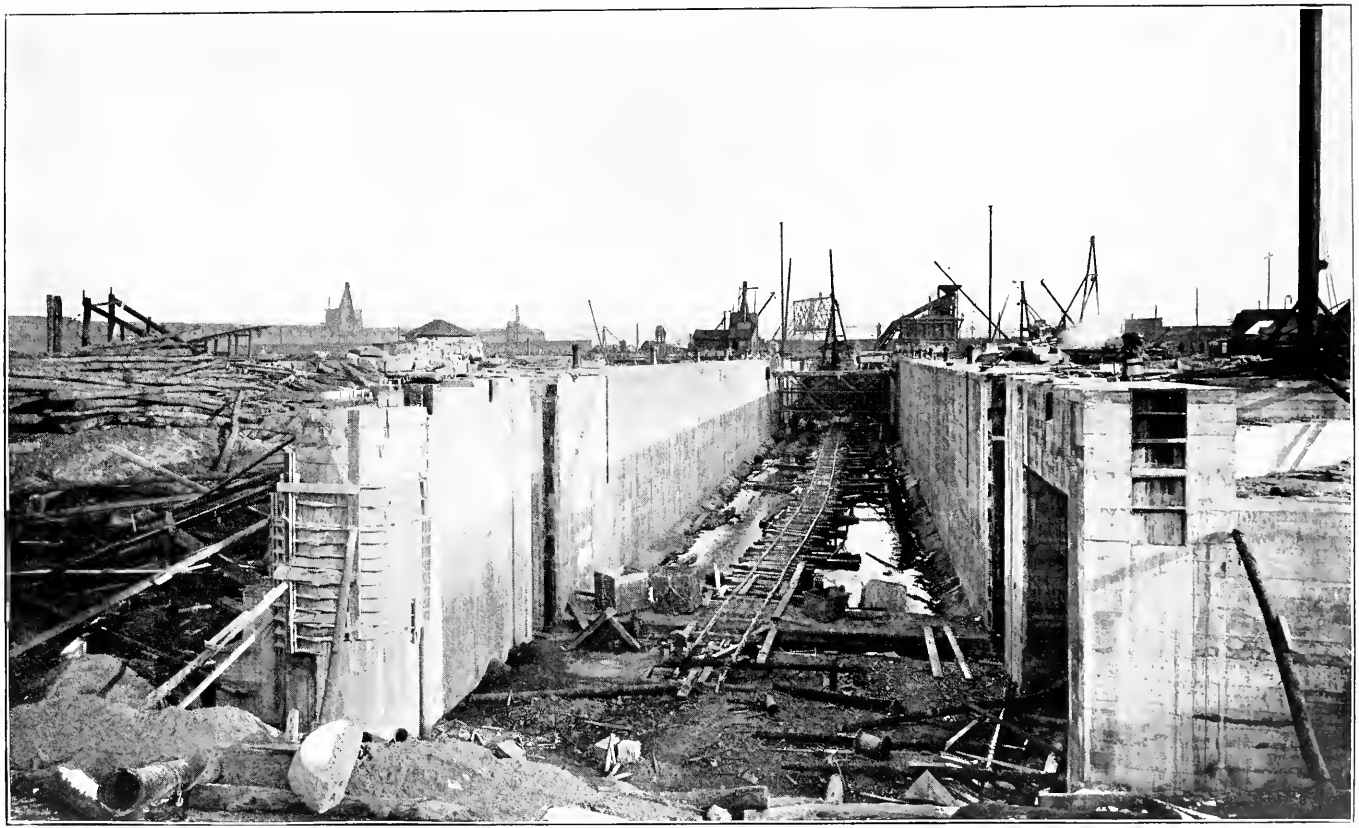
LOCK — EXPANSION JOINTS.



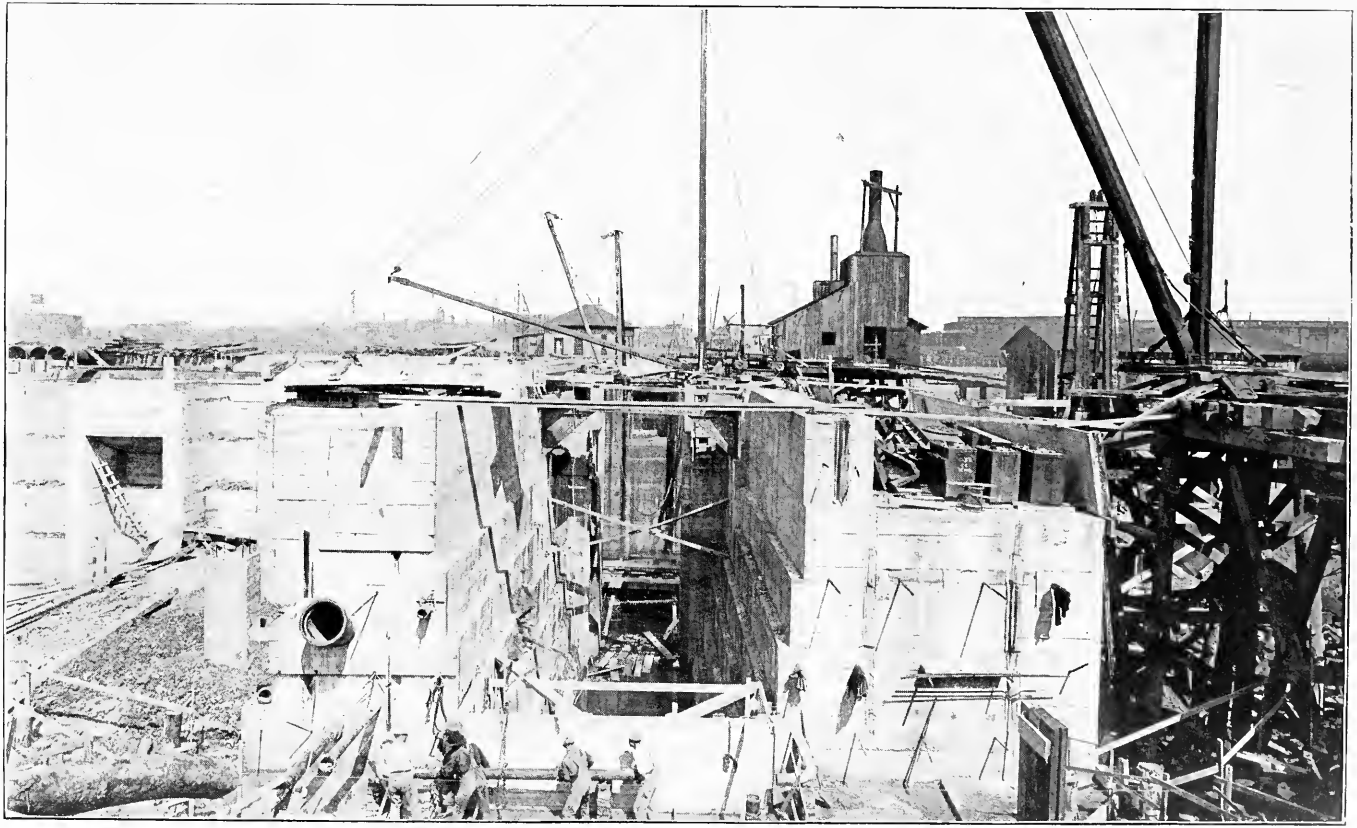
LOCK — BOTTOM COMPLETED.



LOCK—Constructing Side Walls.



LOCK — Looking Down-stream.



LOCK — Lower Gate Recess.

From the results of the experiments, and from what information was obtained by correspondence and from published reports, it was decided to use a layer 6 inches thick for the facing, composed of 1 : 1 : 2 concrete. This was changed to a mortar of 1 : 3, after the results of further experiments were made known. This facing was carried up with the other concrete for the side walls, the 6-inch space being maintained by means of a steel diaphragm 12 inches high and about 10 feet long, with spacers 6 inches long at each end and one in the middle to keep a uniform distance from the forms. As soon as the facing was placed, the diaphragm was removed and the mortar and backing spaded together to make sure of a good bond, and strips of No. 16 gage, 3-inch mesh, expanded metal, 12 inches wide, were placed horizontally in the soft concrete 1 foot apart vertically above elevation 98 and 2 feet apart below that elevation, in order to prevent the facing from separating from the main portion of the wall.

At the end of the period covered by this report, some 28,500 cubic yards of concrete had been placed in the Lock and Boston Marginal Conduit under Contract No. 1.

Lock-gates.

The detail drawings for the Lock-gates, which were being prepared at the beginning of the period covered by this report, were completed and a contract for the construction of the gates made with the New Jersey-West Virginia Bridge Company. Most of the material for the Lock-gates was rolled and delivered to the contractor, but no shop work was done. It was deemed advisable to furnish the axles for the Lock-gate trucks, with the wheels mounted upon them, to the contractor, and contracts were made with The William Cramp & Sons Ship and Engine Building Company for furnishing the manganese bronze axles, and with the Griffin Wheel Company for furnishing chilled cast-iron wheels and mounting them. The use of manganese bronze for the axles was thought best, as this metal, while possessing all the physical properties of structural steel, does not deteriorate in salt water. The strength of the axles will, therefore, not decrease as would the strength of steel axles, and there will be no possibility of rust preventing them from turn-

ing easily in the axle boxes of the trucks, or of preventing the gates from sliding on the axles to a bearing on the timber sills set in the masonry when the direction of the pressure changes with the rise and fall of the tides.

A contract was made with the Coffin Valve Company for furnishing and erecting upon the Lock-gates the necessary sluice-gates, with operating stands, motors, controllers, and all necessary appurtenances for filling and emptying the Lock.

The bearing timbers against which the Lock-gates will seat themselves to make a water-tight joint are 6-inch by 14-inch and 6-inch by 16-inch oak timbers, anchored to the masonry with bolts 1 inch in diameter.

Warping Machinery.

Considerable study was given to the type of warping machines to be employed for expediting the progress of vessels through the Lock. The ordinary form of ship capstan, electrically operated, was finally decided upon, and a contract was made with the American Ship Windlass Company, of Providence, for furnishing and erecting two such capstans.

The Lock masonry has been so constructed that additional capstans may be installed, if experience proves them necessary.

At the same time studies were made of guide sheaves to be used at the edge of the Lock in connection with the capstans, and of types and locations of bollards. These guide sheaves and bollards are of cast iron, and were included in a contract for special castings and other metal made with the Gibby Foundry Company, of East Boston.

Stop-planks at the Lock.

The method of supporting the stop-planks at the ends of the Lock was studied during the previous year, and designs of the trusses and girders, at that time made only in sufficient detail to demonstrate the practicability of the plan, have been completed.

Two contracts were made with the New England Structural Company for furnishing the structural material for these stop-planks and their supports, and a contract was made with the George McQuesten Company for furnishing the yellow pine timber required.

Other Metal at the Lock.

The structural steel work for supporting the roof over the Boston Marginal Conduit outlet chamber, and special castings for supporting the operating machinery for the Lock-gates, have been designed.

Steel for reenforcing the concrete; the adjustable bearings for the Lock-gates, manhole frames and covers; anchorages for holding Lock-gate bearing timbers in place in the masonry; bed-plates for operating machinery; cast-iron pipes for suction and discharge from the pumps, for the conduit under the Lock and for the gage pipes; and the wrought-iron pipes for the electric ducts have nearly all been placed in the masonry.

Heating Plant.

The design of the heating system, which is intended to prevent the formation of ice on the Lock-gates, was based on the experiments made at Mystic Lake during the winter of 1904–05, which were briefly described in the third annual report of the Commission.

Radiators of the size necessary to heat the parts of the gates on which ice may form are to be placed inside the Lock-gates, near the skin plates, and steam will be supplied to these, at the desired pressure, from main pipes laid along the tops of the gates.

The system of air piping to be installed is intended to make it possible for men to work comfortably inside the gates, as well as to supply, under pressure, the air necessary to allow the use of the air locks which give access at all times to the chambers about the trucks on which the gates run. These chambers, open at the bottom, work on the principle of the diving-bell, the pressure of the air inside being sufficient to keep the water from rising, and make it possible not only to get at the trucks at any time, but, by moving the gate slowly, to make an examination of the track without pumping out the Lock-gate recess.

A contract was made with The Lumsden & Van Stone Company for furnishing and erecting in the Lock-gates steam, water and air piping, together with all necessary fittings and hangers.

Complete detail plans for the boiler plant necessary for fur-

nishing steam for heating the Lock-gates, the houses over the Lock-gate recesses, and the gate-house at the sluices, were not made, as it was thought advisable to allow bidders to submit designs with their proposals; but the desired general arrangement was shown, and a table of general data was given in the specifications.

The plant is to consist of two horizontal return tubular boilers, 48 inches in diameter and about 16 feet long, designed to work at a pressure of 125 pounds per square inch, using anthracite coal for fuel and with an induced draft; together with settings, grates, fronts, feed and blow-off piping, gages, uptakes, dampers, flue and all other details necessary.

A contract was made with Lynch & Woodward for furnishing and erecting this plant complete and ready to generate steam.

Superstructures.

The studies for the superstructures over the two Lock-gates were continued, and sketches were completed of the one over the lower Lock-gate recess in its final form. Studies are in progress of the one over the upper Lock-gate recess.

Drawbridge.

As stated in the third annual report of the Commission, a contract was made on Aug. 25, 1905, with The Scherzer Rolling Lift Bridge Company, for the design of a single-leaf, two-part drawbridge of their patented type. The plans submitted by them, twelve in number, were checked, and a contract, based on them, was made with the American Bridge Company of New York for the construction of the bridge. This company prepared forty shop plans, which were carefully examined by The Scherzer Rolling Lift Bridge Company and by one of the engineers of the Commission before being approved by the Chief Engineer, and no work of construction was allowed until such approval had been given. Most of the material for this bridge, ready for erection, has been delivered at the site of the work. The substructure material, to be placed by the Commission, has been erected for the southerly half of the bridge.

Cambridge Coffer-dam.

The design for this coffer-dam, being constructed by the Holbrook, Cabot & Rollins Corporation under Contract No. 1, was modified in a similar way to that of the Boston coffer-dam, the only difference being in the earth slopes, which in this dam, on the outside, were carried up to elevation 110, and on the inside had a berm 10 feet wide at elevation 110, except on the westerly side, which had a berm 15 feet to 20 feet wide in different places. The original plans for this coffer-dam showed the up-stream and down-stream ends carried through the old sea-wall into good material, with a by-pass built to take the flow from the Bridge Street sewer; but on request of the contractor this was modified, so that the entire structure was built complete outside of the sea-wall, on condition of his agreeing to keep the outlet of the Bridge Street sewer open and to make the permanent connection therewith at the proper time.

In order to avoid any trouble from sliding banks when the coffer-dam was being pumped out, most of the silt enclosed by the inside line of sheeting was dredged out before the coffer-dam was closed. The piles on each side of the different rows of cut-off sheeting were not driven until after the coffer-dam was pumped out and the cut-off sheeting was driven, as some of these piles might have interfered with driving the sheeting.

Sluices.

Contract plans for timber sluice-gates for the sluices near the Cambridge end of the Dam were prepared early in the year; but as only one proposal for the work was received, and that at what was considered an excessively high price, it was decided to use metal sluice-gates, and contracts were made with the Coffin Valve Company for furnishing and erecting them.

As the sluices are less than 100 feet long, whereas the Dam is in general from 350 to 500 feet in width, it was very essential that every precaution should be taken to make sure that the water could not make a channel under them; therefore, four lines of cut-off sheeting were driven. Underneath the sluices was found a layer of gravel from 4 to 6 feet thick, through which it was impossible to drive the sheeting piles

without a jet. A 3-inch pump was therefore set up, and by means of a jet the 6-inch yellow pine cut-off sheeting was easily driven through the gravel into stiff blue clay a distance of 6 or 8 feet.

During the driving of the cut-off sheeting, the contractor, the Holbrook, Cabot & Rollins Corporation, was arranging the screens and storage bins and building a derrick to raise the gravel to the top of the screens; and on August 6 the first concrete was placed in the sluices, although the contract required that one-half the masonry should be in place at that time. Concreting was steadily in progress from that date up to the end of the period covered by this report.

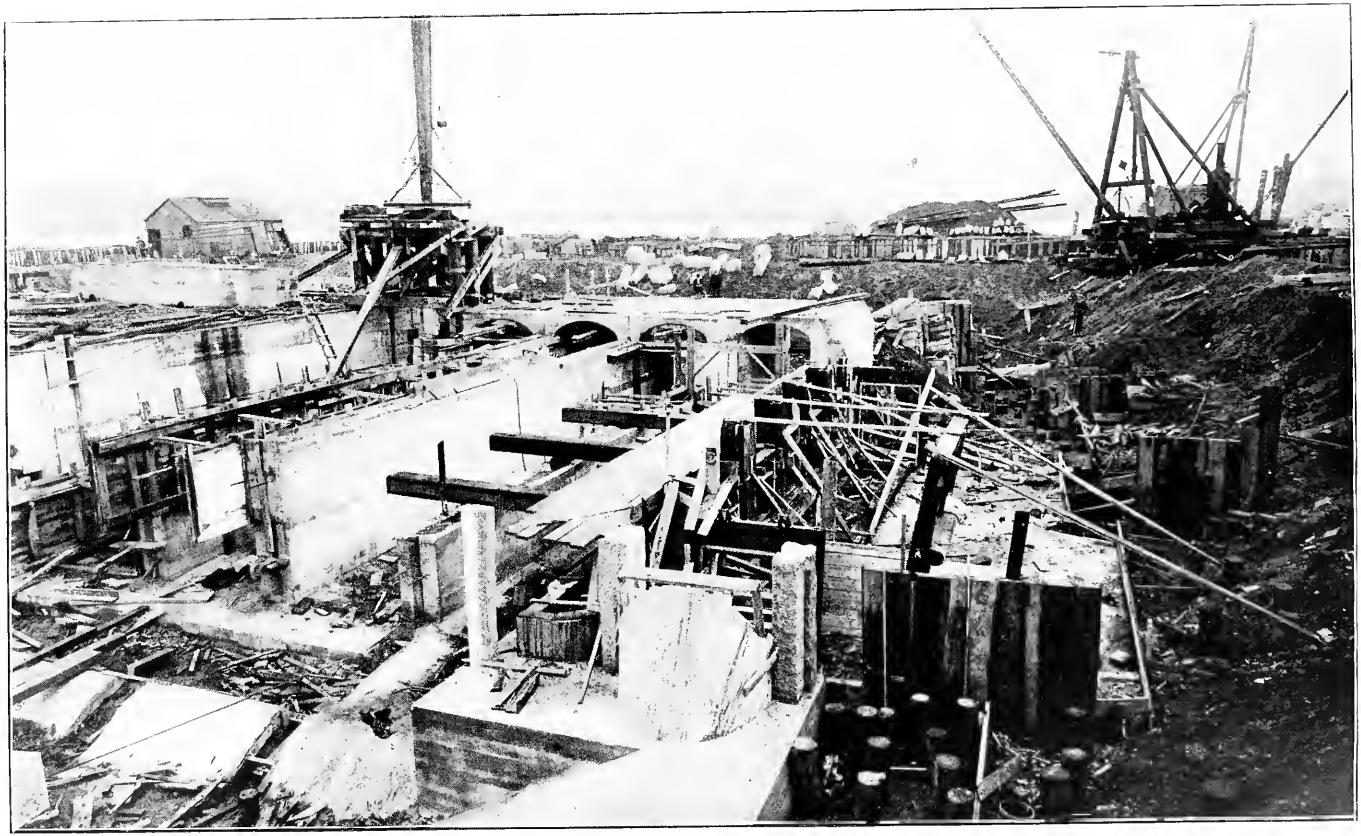
The structural steel work for supporting the roof over the sluices has been designed.

Pumps.

The contractor for the pumps has completed the pumps and machinery, including the electrical appliances, ready for erection as soon as the masonry shall be completed.

Temporary Bridge and Approaches.

This bridge was paved with creo-resinate wooden blocks, by the United States Wood Preserving Company. Before traffic was turned over the bridge bulges began to appear, and as the usual rainy season of the fall came on the bulges became more numerous and extensive, until on some days the traffic was confined almost wholly to the street railway tracks, which were laid with 2-inch spruce plank. The difficulties were called to the attention of the United States Wood Preserving Company, the contractor for the paving, but this company did nothing to put the bridge in satisfactory condition. Finally, on Nov. 1, 1905, it was decided to replace, except in some small places, the wood block paving on the Cambridge side of the draw with 2-inch spruce plank. This work was started on November 3 and completed on November 25. During the fourteen months covered by this report nearly 150 M. feet B.M. of 2-inch spruce were required to keep the surface of the bridge in usable condition. In June a 4-inch wrought-iron pipe was laid from the Cambridge side of the river to the draw, with 2½-inch connections



SLUICES — WESTERLY PORTION.

every 100 feet, to which could be attached a 2½-inch fire hose in case of the bridge getting on fire. No occasion has arisen for its use, however, since it was installed.

The draw has been operated without any serious delays to traffic over it during the fourteen months. The longest time it was closed to street travel was on Dec. 12, 1905, from 11.15 A.M. to 1.30 P.M. This was caused by the boom of a lighter, while passing through the draw, striking the trolley wires and causing a short circuit of the current, so that there was no power to operate the motors until after repairs could be made.

Boston Marginal Conduit and Boston Embankment.

The construction of the Boston Embankment by the Commission having been authorized by the General Court, plans and specifications for two sections were prepared and contracts made for this work, in connection with which the Boston Marginal Conduit will be constructed.

The first of these sections, known as Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment, extends from the Cambridge Bridge to a point between Berkeley and Clarendon streets, a distance of about 2,700 feet. It requires about 360,000 cubic yards of earth filling, 200,000 linear feet of piles, 6,300 cubic yards of concrete masonry and 900 cubic yards of stone masonry. Coleman Brothers, of Boston, were the lowest bidders for this section, and a contract for the work was made with them.

The second section, known as Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment, extends from the end of the section described above, between Berkeley and Clarendon streets, to a point between Fairfield and Gloucester streets. It requires about 145,000 cubic yards of earth filling, 170,000 linear feet of piles, 5,700 cubic yards of concrete masonry and 900 cubic yards of stone masonry. The Holbrook, Cabot & Rollins Corporation, of Boston, was the lowest bidder for this section, and a contract for the work was made with that company.

Plans and specifications for the next section, to be known as Section 5 of the Boston Marginal Conduit and Section 3 of the Boston Embankment, were being prepared at the end of

the period covered by this report. This section will extend from the end of the section last described, between Fairfield and Gloucester streets, to a point about 50 feet east of Charlesgate East.

One more short section of conduit and embankment, including the gate-house at the Fens, will be necessary to complete this work to Charlesgate West.

The work of driving piles and placing concrete in Section 1 of the Boston Marginal Conduit was prosecuted by the Holbrook, Cabot & Rollins Corporation, under Contract No. 1, as opportunity offered during the season, until at the end of the period covered by this report all of the conduit between the upper and lower gate recesses was completed and the embankment over the same had been made. The overflow from the Chambers Street sewer caused serious interruption to the progress of the work several times during the year. After heavy rainfalls occurring during high tides, this overflow, being the only one not closed by tide-gates, discharged the overflow from the entire section of the west side interceptor from the North Station to Cambridge Street, causing several bad washouts and stopping up the underdrain for a week at a time.

As the Boston Marginal Conduit was built, a concrete connection was made with the overflow from Chambers Street, 2 feet wide by 2 feet 6 inches high; and in order to prevent any further washing of the fresh work at the ends of the sections, as the structure was extended, wooden bulkheads were built on each side of the overflow inside of the Boston Marginal Conduit, and the overflow conducted directly to the underdrain by a 12-inch vitrified pipe extending through the side wall of the Boston Marginal Conduit and connected directly with the contractor's main drain.

At the end of the period covered by the last annual report, nearly 800 feet of Section 2 of this conduit, being constructed by James Driscoll & Son, under Contract No. 3, had been completed from a point in the men's playground at the Charlesbank to a point about 250 feet south of Allen Street, and work had just been started on excavating a trench for the conduit across Cambridge Street. The work at Cambridge Street was difficult, as the sea-wall was only a few feet away, and the

broken stone filling in the rear of the wall acted as an open drain to bring the water of the river into the trench, and it was soon found that work could be done here only at low water. But work was pushed day and night, including Sundays, at low water, until October 24, when, after 70 feet of conduit had been completed, work was suspended at the request of the city engineer of Boston, and nothing further was done here until November 15. During this interval the work was carried on vigorously through the women's gymnasium and playground, and the crossing of the Fruit Street overflow was successfully accomplished. At Fruit Street a second overflow was found below the one in use, with its invert at elevation 100–. This lower overflow brought considerable water into the trench, but after the openings on each side of the trench were filled with sand bags and bulkheaded off, little further trouble was found.

Early in November excavating was started for the overflow chamber and conduit, and a bull-wheel derrick with a 60-foot boom was set up to handle the excavation and the heavy iron troughs which were to be placed in the chamber. During November and December the work on the overflow chamber and conduit was continued, and on the last day of December the last pile was driven under this contract. The 60-inch pipe at the end of the overflow conduit was put in place December 27, and the work of smoothing up the interior surface of the overflow conduit and calking the leaks was continued. Work was resumed at Cambridge Street on November 15, and an effort was made to complete the conduit beyond the southerly line of the approach to the new Cambridge bridge. In order to hasten the progress of the work at this point, 3-inch splined sheeting was furnished the contractor by the Commission. The interior finish of the conduit consisted of a skim coat on the invert and a cement wash on the side walls and arch. This gave satisfactory results. Some leaks developed, probably due to contraction of the masonry; but these were all made tight, the worst of them by cutting out a small groove from 1 inch to 1½ inches deep, and then calking into the groove soft "tea lead," after which it was plastered with neat cement in the usual manner. The elevation of the invert of the conduit is about 2.0 feet below mean low water, and the ground water stands at all times above

the top of the arch; but from the time the pumping was stopped, in February, 1906, until Nov. 30, 1906, the leakage into the conduit only filled it to a depth of 14 inches.

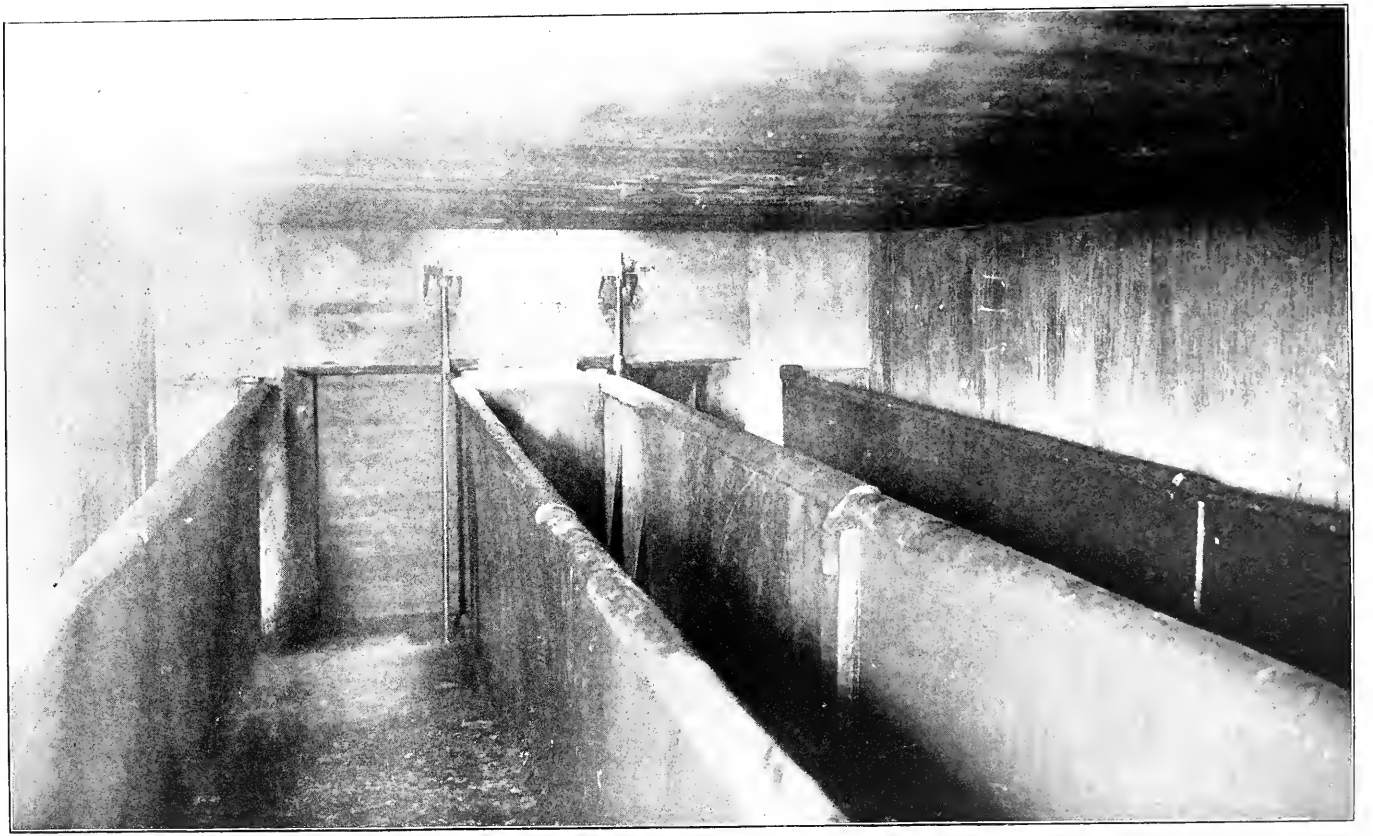
On Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment, being constructed by Coleman Brothers, under Contract No. 44, filling has been in progress from the shore at Revere Street, Cambridge Street, and some 100 feet east of Otter Street. Over 10,000 cubic yards have been deposited in this way.

About 50 feet of completed conduit have been built, and some 30 feet more of trench were nearly down to grade. The contractor desired to make use of the Blaw Collapsible Steel centers, and he was given permission to give them a trial. Piles have been driven for the conduit for a distance of nearly 1,000 feet, but the contractor has been requested not to drive any more piles until the results of filling over the piles already driven can be noted, as there is a possibility that the piles may move while the filling is going on. Excavating sand and gravel with a dredge and depositing it under the line of the proposed Basin wall and excavating ordinary earth and depositing it in the embankment have been in progress.

The filling near the West Boston temporary bridge pushed out some of the piles at the up-stream end of the bents of the bridge, and caused a settlement of the sidewalk and roadway during the week beginning November 19; and on Saturday, November 24, a portion of the up-stream half of the roadway was fenced off to public traffic, and a close watch was kept on the rest of the bridge at that point. On Tuesday, November 27, however, traffic was diverted to the new Cambridge bridge.

On Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment, being constructed by the Holbrook, Cabot & Rollins Corporation, under Contract No. 50, a dredge has been used to excavate sand and gravel and deposit it for a dike under the line of the proposed Basin wall. Up to the end of the year some 5,000 cubic yards of material have been excavated and deposited under or adjacent to the line of the Basin wall at the lower end of the section.

On Feb. 5, 1906, after being in operation nearly two years, all of the recording gages that had been placed on the sewer



BOSTON MARGINAL CONDUIT — CAST-IRON OVERFLOWS.

overflows on the Boston side of the river, between Brimmer Street and St. Mary's Street, were abandoned, except the one at the junction of Beaver and Beacon streets. In order to obtain a partial record of the heights to which the sewage is backed up in the sewers at times of high tide, whitewashed laths were substituted for these gages in the various manholes, and observations were taken of the high-water marks shown on the laths, by weekly inspections or whenever a storm of sufficient magnitude to cause an overflow occurred. The gage at Beaver Street has been continued, because it shows the approximate elevation of the sewage in the west side interceptor, being located in a manhole having a free connection with the interceptor through a 16-inch pipe and only 8 feet distant from the interceptor.

Dredging in the Basin.

Some 60,000 cubic yards of material were dredged from the Basin, under Contract No. 1, with the Holbrook, Cabot & Rollins Corporation, in front of property on the northwesterly side of the river below Broad Canal, the greater portion of this material being deposited in Section 1 of the Boston Embankment.

Broad and Lechmere Canals.

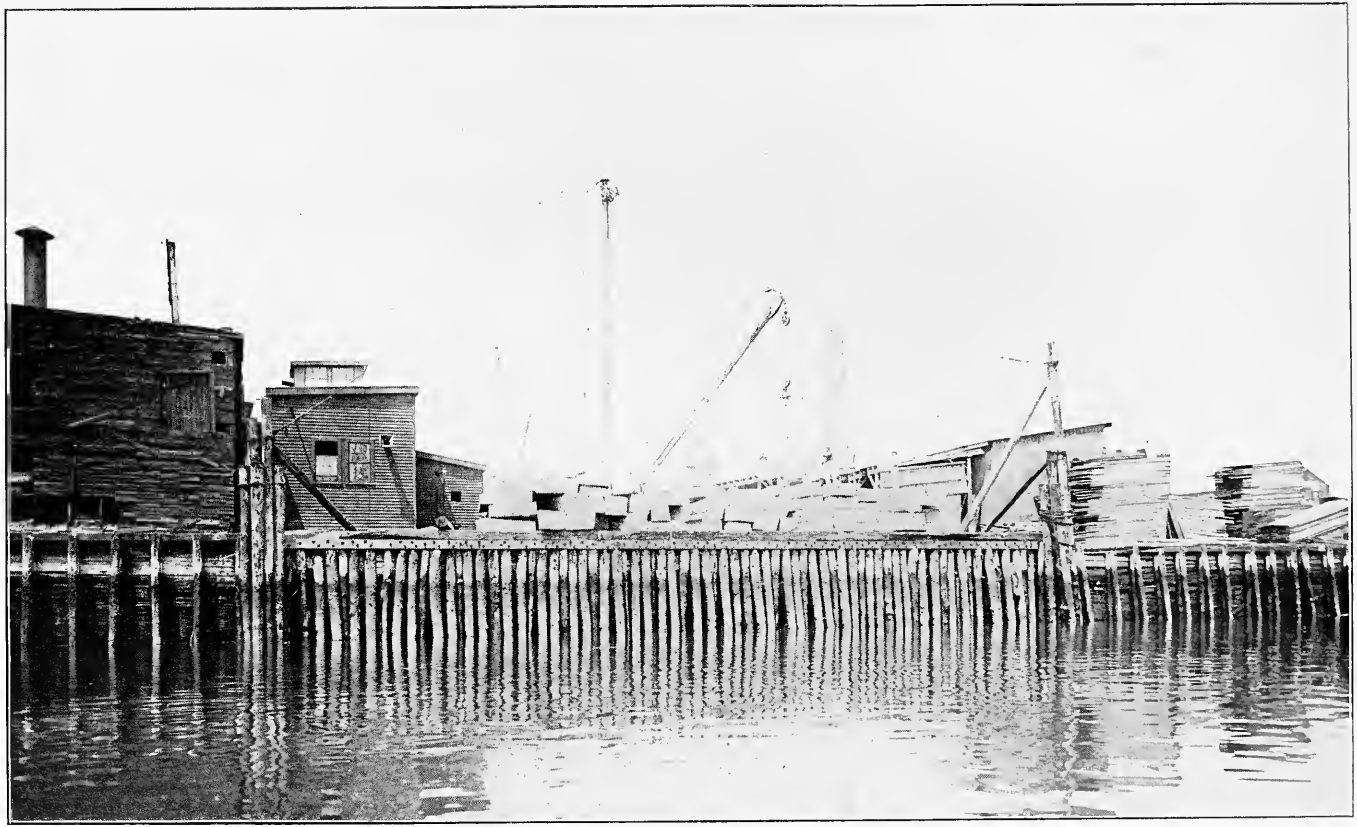
Section 4 of chapter 465 of the Acts of 1903 provided that before the Dam was completed the dredging in the canals should be done, and the walls or wharves should be strengthened by driving in front of said walls or wharves prime oak piles 2 feet on centers. This work has been prosecuted by the Holbrook, Cabot & Rollins Corporation, under Contracts Nos. 1 and 23. As soon as piles were received the contractor began the work of driving them. At first the piles were driven 4 feet on centers, in order to allow the use of the ordinary pile-driver, as the side of the gins prevented the piles from being spaced as closely as 2 feet on centers. Later on, however, all of the piles were driven with an outrigger, and by this means were driven 2 feet on centers without any difficulty. Before driving piles in front of any of the properties fronting on the Basin and the canals, releases from damages were secured from the owners.

At the end of the period covered by this report the pile-driving was completed as follows: in Broad Canal, at all places on the northerly side except at Connery & Wentworth's and at portions of the properties of Warren Brothers Company and Reuben Sherburne, where there is neither wall nor bulkhead; in Broad Canal, on the south side, at all places except in front of the properties of the city of Cambridge, Charles A. Morss, John J. Horgan, heirs of Howard Coon, estate of Willard Dalrymple, Matthews & Fay, Sylvester Tower Company, and the portion of the Geo. G. Page Box Company property above the railroad bridge; in Lechmere Canal the piles are driven except in front of properties of the Wellington-Wild Coal Company, the Linehan estate, a portion of the Peters estate, Charles E. Hall & Co., and John T. Scully.

Some 20,000 cubic yards of material were excavated in Broad Canal, the greater portion of which was deposited in Section 1 of the Boston Embankment.

Prior to beginning dredging in Broad Canal, an effort was made, but without success, to come to some agreement with the abutters, by which the dredging could be done on certain days of the week, and on the other days leave the canal free for the movement of vessels up and down the canal.

While dredging was in progress, on September 10, the barge "Devon," on its way up the canal, grounded on the southerly side of the canal at a point about opposite the property of the Consumers' Coal Company, and was unable to get off until September 15. During this week another effort was made to come to some agreement with the towboat companies and coal companies as to the method and time for doing the dredging, but without result. On October 5 another conference was held between the dredging contractor and the coal companies having wharves along Broad Canal, but no satisfactory solution was reached. During the latter part of the month of October the Commission notified the property owners and towboat companies that the Commission would begin dredging Broad Canal on November 1, and that the canal would be closed to traffic while dredging was going on, and would continue the work until such time as the Commission thought it safe for traffic to be resumed. Dredging was resumed in Broad Canal on No-



LECHMERE CANAL -- After Driving Prime Oak Piles.

vember 1, and was continued day and night with only slight interruptions to the end of the period covered by this report; the work was then completed to within 400 feet of the Third Street draw.

Land Takings.

A taking plan was made of land along the Boston shore of the Charles River from the Cambridge Bridge to Charlesgate West.

Upland Flow of the Charles River.

A recording gage, showing the depth of water flowing over the dam at the Waltham Bleachery, was maintained, and weekly current meter observations were taken of the flow in the canal past the Bleachery Dam.

Table No. 1 shows the estimated average flow of the Charles River at the Waltham Bleachery for weekly periods. The area of the watershed above the Waltham Bleachery is taken to be 169 square miles; this excludes 70 square miles assumed to be tributary to Mother Brook and 24 square miles tributary to the Cambridge reservoirs. Whenever these reservoirs overflowed into the Charles, the amount, as furnished by Mr. L. M. Hastings, city engineer of Cambridge, has been deducted from the total discharge measured at the Waltham Bleachery.

Table No. 2 shows the number of days during the period covered by this report when the upland flow of the Charles River at the site of the Dam, estimated from the records kept by the Charles River Basin Commission at the Waltham Bleachery, was more than 500 cubic feet per second for twenty-four hours.

Table No. 3 shows the length of time during which a normal tide will be higher than the water in the Basin, and the rise of the Basin during that interval for various rates of upland flow.

Diagram No. 1 shows the daily flow of the Charles River at the Waltham Bleachery, in connection with the rainfall at Chestnut Hill, taken from the records of the Metropolitan Water Works.

TABLE NO. 1. — *Estimated Weekly Average Flow of Charles River at the Waltham Bleachery, Sept. 30, 1905, to Nov. 30, 1906.*

WEEK ENDING —	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.[1]	WEEK ENDING —	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.[1]
1905.			**1906.**		
Oct. 7,	107	.64	May 5,	287	1.70
14,	57	.34	12,	302	1.79
21,	45	.27	19,	236	1.40
28,	101	.60	26,	153	.91
Nov. 4,	69	.41	June 2,	225	1.33
11,	67	.40	9,	336	1.99
18,	93	.54	16,	204	1.21
25,	73	.43	23,	158	.94
Dec. 2,	84	.50	30,	121	.72
9,	155	.92	July 7,	133	.79
16,	165	.98	14,	164	.97
23,	136	.80	21,	127	.75
30,	218	1.29	28,	134	.79
			Aug. 4,	106	.63
1906.					
Jan. 6,	238	1.41	11,	108	.64
13,	243	1.44	18,	162	.96
20,	248	1.47	25,	152	.90
27,	323	1.91	Sept. 1,	114	.67
Feb. 3,	306	1.81	8,	68	.40
10,	174	1.03	15,	53	.31
17,	169	1.00	22,	23	.14
24,	253	1.50	29,	70	.41
Mar. 3,	406	2.40	Oct. 6,	106	.63
10,	567	3.36	13,	93	.55
17,	561	3.32	20,	110	.65
24,	372	2.20	27,	152	.90
31,	440	2.60	Nov. 3,	218	1.29
Apr. 7,	600	3.55	10,	166	.98
14,	518	3.07	17,	169	1.00
21,	514	3.04	24,	221	1.30
28,	372	2.20	Dec. 1,	181	1.07

[1] Area of watershed is 169 square miles.

TABLE NO. 2. — *Number of Days from Sept. 30, 1905, to Nov. 30, 1906, when Estimated Upland Flow of Charles River at the Site of the Dam was More than 500 Cubic Feet per Second for Twenty-four Hours, from Records kept by the Charles River Basin Commission at the Waltham Bleachery.*

MONTH.	500-750 Cubic Feet per Second (Days).	750-1,000 Cubic Feet per Second (Days).	1,000-1,500 Cubic Feet per Second (Days).	1,500-2,000 Cubic Feet per Second (Days).	2,000-2,500 Cubic Feet per Second (Days).	Total Number of Days exceeding 500 Cubic Feet per Second.	Rainfall at Chestnut Hill (Inches).	Average Rainfall on Sudbury Watershed for Thirty-one Years (Inches).
1905.								
October,	–	–	–	–	–	–	1.53	4.14
November,	–	–	–	–	–	–	2.51	3.89
December,	–	–	–	–	–	–	4.27	3.82
1906.								
January,	1	–	–	–	–	1	3.65	4.24
February,	5	–	–	–	–	5	3.17	4.27
March,	9	14	–	–	–	23	7.42	4.55
April,	12	12	–	–	–	24	2.62	3.58
May,	–	–	–	–	–	–	5.43	3.28
June,	2	–	–	–	–	2	3.56	3.15
July,	–	–	–	–	–	–	4.13	3.73
August,	–	–	–	–	–	–	1.82	4.01
September,	–	–	–	–	–	–	2.92	3.43
October,	–	–	–	–	–	–	3.71	4.14
November,	–	–	–	–	–	–	3.37	3.89
Totals,[1]	29	26	–	–	–	55	50.11	54.12
1904-05,[2]	21	25	5	–	–	51	–	–
1903-04,[2]	29	18	13	5	1	66	–	–

[1] 14 months. [2] One year.

The flow at the site of the Dam was obtained from that at the Waltham Bleachery by applying the yield per square mile given in Table No. 1 and adding the waste from the Cambridge reservoirs watershed as obtained from the records kept by the city of Cambridge.

TABLE NO. 3. — *Time during which a Normal Tide will be Above the Water in the Basin, and Rise of Basin during that Interval for Various Rates of Upland Flow.*

Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be Above Basin.		Rise of Basin (Feet).	Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be Above Basin.		Rise of Basin (Feet).
	Hrs.	Min.			Hrs.	Min.	
500	3	48	.20	3,000	3	19	1.02
1,000	3	42	.39	4,000	3	8	1.28
1,500	3	36	.56	5,000	2	58	1.51
2,000	3	30	.72	6,000	2	49	1.71
2,500	3	25	.87				

TRAFFIC THROUGH DRAW OF CRAIGIE BRIDGE AND OF TEMPORARY BRIDGE.

A record has been kept of the traffic through the draw of the temporary bridge. This record gives the tonnage, draft and time of passage of vessels of different kinds. Some of the results of the records obtained are shown by the following diagrams: —

Diagram No. 2 shows weekly totals of cargoes, in tons, not including the material furnished for the Charles River Dam, passing through the temporary bridge for the period included in this report.

Diagram No. 3 shows the monthly totals of cargoes, in tons, not including the material furnished for the Charles River Dam, passing through Craigie Bridge or the temporary bridge since Nov. 30, 1899. This diagram indicates a general tendency of the tonnage to decrease from year to year.

Diagram No. 4 shows the yearly number of vessels passing through Craigie Bridge or the temporary bridge since Sept. 30, 1885, and the number of times the draw has been opened per year since Sept. 30, 1871, the only complete years covered by existing records.

MISCELLANEOUS ENGINEERING WORK.

One hundred and sixty-three finished plans were made during the period covered by this report, in addition to numerous studies and sketches. Two hundred and sixty-one plans were

indexed and filed, which, with the plans previously filed, make a total of 696 plans.

Two hundred and thirty-one photographs were taken by Mr. Luther H. Shattuck.

Contracts.

Thirty-two contracts were let during the period covered by this report. The preparation of the various contract plans and specifications, estimates, supervision of the work, etc., occupied a considerable portion of the time of the engineering force. A detailed statement of the contracts made and pending during the period covered by this report is given in Appendix B.

Following are additional descriptions of some of these contracts, except so far as the work done under them has already been described under the headings of "Dam and Lock," "Boston Marginal Conduit and Boston Embankment," "Dredging in the Basin" and "Broad and Lechmere Canals."

Contract No. 1, Holbrook, Cabot & Rollins Corporation. — Dam and Lock in the Charles River, Boston and Cambridge.

On Jan. 14, 1905, a contract was made with the Holbrook, Cabot & Rollins Corporation for the construction of the Dam and Lock. A general description of the work to be done under this contract is given in the report for the year ending Sept. 30, 1905.

On Oct. 5, 1905, the work of driving piles for the Cambridge coffer-dam was started, and the work was carried on during the fall and winter as the weather and the rest of the work permitted. Some delay was caused to the work by the difficulty in obtaining the yellow pine sheeting from the South at the proper time, and it was not until June 23 that the pumping out of the coffer-dam was started.

On Oct. 6, 1905, the sluice-gates in the Boston coffer-dam were closed at low water, and on October 11 the work of pumping out the coffer-dam was commenced.

On Nov. 1, 1905, the work of driving piles for the foundation of the Lock was started.

During the winter the building of the concrete mixing and handling plant went steadily along.

Piles were driven for the foundation of Section 1 of the Boston Marginal Conduit during January, February and March, 1906, but the concrete structure was not started until during the month of July, when work was commenced on the portion immediately east of the lower gate recess.

On April 3, 1906, the first concrete was laid under the lower gate recess, and since that date concreting has been continuously in progress, so that at the end of the period covered by this report all that remains to be done is a little concrete at the outlets of the Boston Marginal Conduit, and a short section of the Boston Marginal Conduit above the upper gate recess where connection is to be made with Section 2 of the Boston Marginal Conduit built by James Driscoll & Son, under Contract No. 3.

In January, February and March, 1906, the piles under the sluices were being driven by a water machine with extension gins.

On June 23, 1906, the pumping out of the Cambridge coffer-dam was started, with water at elevation 101.5. On June 25 the water was at elevation 97.5, and on June 27 the pumping out was finished and trenches were being dug to conduct the water to the pump-well. Grading off the fill over the tops of the piles was immediately started, and as fast as possible the tops of the piles were sawed off to grade.

The driving of the cut-off sheeting at the sluices was started on July 11, and the four lines were completed on August 1, except for the portions that were outside the walls of the sluices.

Dredging was started at the entrance to Broad Canal on August 25, and was continued with only short interruptions from that date until the end of the period covered by this report.

The total value of the work performed, as shown by the November, 1906, estimate, was $468,709.83, the principal items of which were as follows: —

Coffer-dam at the Boston end,	85	per cent. completed.
Coffer-dam at the Cambridge end,	85	per cent. completed.
Earth excavation,	295,378	cu. yds.
Round piles in place (exclusive of coffer-dams),	282,234	lin. ft.
Spruce lumber in place,	131	M. ft. B. M.
Concrete masonry,	31,700	cu. yds.
Granolithic surfacing,	330	sq. yds.

Ashlar masonry,	113 cu. yds.
Dimension stone masonry,	63 cu. yds.
Face dressing,	1,400 sq. ft.
Iron and other metal work placed,	527 tons.
Special work,	$1,232.73
Extra work,	54,077.24

Contract No. 2, United States Wood Preserving Company. — Wooden Block Paving for Temporary Bridge, Boston and Cambridge.

On March 23, 1905, a contract was made with the United States Wood Preserving Company for furnishing and laying the wooden block paving for the temporary bridge.

As no maintenance work was done by the contractors under their four years' maintenance guarantee, and the condition of the bridge was such that it was deemed necessary to replace a large portion of the blocks with spruce plank, no additional payments have been made under this contract.

Contract No. 3, James Driscoll & Son. — Section 2 of the Boston Marginal Conduit, Boston.

On June 13, 1905, a contract was made with James Driscoll & Son for the construction of the Boston Marginal Conduit between the Dam and the southerly side of Cambridge Street. A description of the work called for by this contract was given in the report for the year ending Sept. 30, 1905.

Work on this contract was continued, that in progress at Cambridge Street being suspended on October 24, at the request of the city engineer of Boston, and resumed again on November 15.

On December 11 the weather became so cold that it was found necessary to heat the sand, gravel and water, in order to lay concrete, and this was done most of the time until the completion of the work. On December 1 the work of finishing the interior of the conduit was started, and was continued, with occasional interruptions caused by accidents to the pumping plant, until the completion of the work on February 21.

The final estimate on this work was submitted June 30, 1906, amounting to $52,383.10, the principal items being as follows: —

Earth excavation and refill (main conduit),	1,803.90	lin. ft.
Earth excavation and refill (overflow conduit),	172.10	lin. ft.
Rock excavation,	233.19	cu. yds.
Piles,	51,764.40	lin. ft.
Underdrain,	1,976.10	lin. ft.
Concrete masonry,	2,650.40	cu. yds.
Placing iron and other metal work,	45.77	tons.
Sheeting left in place,	56.60	M. ft. B. M.
Crossings of Fruit and Cambridge street overflows.		
Extra work,	$3,857.47	

Contract No. 4, Camden Iron Works. — Cast-iron Pipes and Special Castings, Boston and Cambridge.

On July 18, 1905, a contract was made with the Camden Iron Works for a portion of the cast-iron pipes and specials to be embedded in and attached to the masonry in connection with the Dam and Lock and the Boston Marginal Conduit.

The final estimate on this contract was submitted on Jan. 22, 1906, amounting to $5,833.86. The quantities in the final estimate were as follows: —

Straight pipe, of sizes varying from 6-inch to 60-inch,	115.23	tons.
Standard special castings,	16.39	tons.
Special castings other than standard,	23.72	tons.

Contract No. 5, Henry R. Worthington. — Furnishing and erecting Pumps, Boston and Cambridge.

On Sept. 30, 1905, a contract was made with Henry R. Worthington for furnishing and erecting pumps. A description of the work called for under this contract is given in the report for the year ending Sept. 30, 1905.

These pumps and motors being completed in the shop, an estimate for 30 per cent. of the contract price, amounting to $2,859.90, has been paid the contractor.

Contract No. 6, Gibby Foundry Company. — Furnishing Castings and Other Metal, Boston and Cambridge.

On July 27, 1905, a contract was made with the Gibby Foundry Company for the greater part of the special castings required for the Lock and Section 1 of the Boston Marginal Conduit.

The final estimate under this contract was submitted May 15, 1906, amounting to $6,262.48. The principal items of the work were: —

Unfinished castings,	29,079 pounds.
Finished iron castings,	83,205 pounds.
Finished steel castings,	5,254 pounds.
Rods, bolts, etc.,	6,373 pounds.

Contract No. 23, Holbrook, Cabot & Rollins Corporation. — Furnishing, driving and capping Piles, Cambridge.

On Dec. 4, 1905, a contract was made with the Holbrook, Cabot & Rollins Corporation for piles along the walls of the canals and Basin in Cambridge.

The work called for under this contract consisted in driving piles along the walls and wharves in Broad and Lechmere canals and the private property along the Cambridge side of the Basin between these canals, as provided in section 4 of chapter 465 of the Acts of 1903.

On Dec. 30, 1905, the first pile was driven in front of the property of the Rawson & Morrison Manufacturing Company, on the southerly side of Broad Canal.

The preliminary estimate of the work to be done under this contract was $55,117.26. The value of the work done at the end of the period covered by this report, as shown by the November, 1906, estimate, was $51,279.98. The principal items of work performed were as follows: —

Oak piles in place,	3,122
Long-leaf yellow pine in place,	71.4 M. ft. B. M.
Iron or steel in place,	65,788 pounds.

Contract No. 24, American Bridge Company of New York. — Constructing a Scherzer Rolling Lift Bridge, Boston.

On March 5, 1906, bids were received for the construction of a Scherzer rolling lift bridge, and on March 16, 1906, a contract was made with the American Bridge Company of New York for the construction of this bridge for $40,800.

This contract provides for the construction of a bridge 85 feet wide, with a span of some 50 feet. The bridge consists of

a single leaf, operated in halves, rising toward the Cambridge end. The contract calls for the erection of the bridge, complete, with all the machinery, including electrical motors and appurtenances; it also requires the contractor to maintain the bridge for a period of twelve months after it has been completed.

At the close of the period covered by this report, nearly the whole of the material, except the electrical apparatus, for this bridge had been delivered, and nearly one-half of the substructural material had been embedded in the concrete by the Commission, acting through the Holbrook, Cabot & Rollins Corporation, the contractor under Contract No. 1.

The value of the work done at the end of the period covered by this report, as shown by the November, 1906, estimate, was $7,559.83.

Contract No. 25, Coffin Valve Company. — Furnishing Sluice-gates at the Sluices in the Dam, Cambridge.

On March 16, 1906, a contract was made with the Coffin Valve Company for the large gates for the sluices.

The contract calls for furnishing eight sluice-gates with clear openings of 7 feet 6 inches by 10 feet, with operating stands, motors, controllers and appurtenances. The gates, motors, etc., will be designed and proportioned to have ample strength, durability, stability and stiffness, and will be so arranged as to allow ample space for repairing, inspecting and adjusting. The contractor is also required to maintain the gates for two years.

A small amount of work was done under this contract and some of the anchor bolts were delivered. No payments were made. The amount of the contract was $24,800.

Contract No. 27, Coffin Valve Company. — Furnishing Sluice-gates on the Lock-gates in the Lock, Boston.

On March 6, 1906, a contract was made with the Coffin Valve Company for furnishing the sluice-gates on the lock-gates at the Lock, for the sum of $17,093.

The work to be done under this contract consists in furnishing and erecting on the Lock-gates fourteen sluice-gates to be used for Lock-filling gates, together with operating stands, motors, controllers and appurtenances.

Considerable work has been done under this contract, but no material has been delivered and no payments have been made.

Contract No. 28, Coffin Valve Company. — Furnishing Tide-gates at the Dam and Lock, Boston and Cambridge.

On March 16, 1906, a contract was made with the Coffin Valve Company for furnishing and erecting twenty-five tide-gates at the Dam and Lock, the contract price for the gates being $4,438, consisting of the following items: —

Item No. 1, Boston Marginal Conduit: 4 tide-gates without counterweights,	$687 00
Item No. 2, Boston Marginal Conduit: 5 tide-gates with counterweights,	1,213 00
Item No. 3, Sluices: 4 tide-gates on a single frame, no counterweights,	448 00
Item No. 4, Sluices: 7 tide-gates without counterweights,	976 00
Item No. 5, Sluices: 5 tide-gates with counterweights,	1,114 00

The gates were delivered, and an estimate of $2,662.80 was paid under the contract.

Contract No. 30, New Jersey-West Virginia Bridge Company. — Constructing Lock-gates, Boston.

On May 14, 1906, bids were opened for the construction of the rolling lock-gates in the Lock, and on June 13, 1906, the contract was awarded to the New Jersey-West Virginia Bridge Company for $26,784.

The contract calls for the erection of two gates, some 47 feet long and 6 feet thick, the one at the lower end of the Lock to be some 31 feet high and the one at the upper end of the Lock about 26 feet high. The gates are of the nature of steel caissons, having water-tight compartments. The contract includes the furnishing of the trucks on which the gates rest, but does not include the furnishing of the wheels and axles.

The contract calls for the completion of the lower gate in the shop on Sept. 30, 1906, and of the upper gate on Oct. 30, 1906. A large portion of the material had been delivered in the shop, but at the end of the period covered by this report shop work had not been commenced.

Contract No. 33, Chelmsford Foundry Company. — Furnishing Castings and Other Metal, Boston and Cambridge.

On April 30, 1906, bids were opened for furnishing castings and other metal for use at the Dam and Lock, and on May 23, 1906, a contract was made with the Chelmsford Foundry Company for this material. The amount of this contract, on the basis of award, is $2,025.10. The principal items called for under the contract were as follows: —

Iron castings,	65,500 pounds.
Checkered steel plates,	8,300 pounds.

The work has progressed very slowly, and has required a great deal of inspection. Although the contract called for its completion on July 22, 1906, at the end of the period covered by this report the contract was far from completion.

The total value of work done, consisting of 33,186 pounds of iron castings, as shown by the last estimate within the period covered by this report, was $713.50.

Contract No. 35, Gibby Foundry Company. — Furnishing Castings and Other Metal, Boston and Cambridge.

Bids for the work to be performed under this contract were asked to be deposited May 24, 1906, and on May 29, 1906, the contract was placed with the Gibby Foundry Company. The amount of this contract, on the basis of award, is $3,322.

The work consists of furnishing castings and other metal for use mainly at the Lock, including bollards and guide sheaves to be used in connection with the capstans in handling vessels in the Lock.

The principal items called for in the contract are as follows: some 50,000 pounds of iron castings and 18 bollards complete.

The contract provided that the material should be delivered within sixty days of the date of the contract, but the work progressed very slowly, and at the end of the period covered by this report a small amount still remained to be done.

The value of work completed, as shown by the October, 1906,

estimate, was $2,644.32. The principal items of the work done were as follows: —

Iron castings,	37,680 pounds.
Bollards, complete,	18.

Contract No. 37, American Ship Windlass Company. — Furnishing and erecting Electric Dock Capstans at Lock, Boston.

On May 24, 1906, a contract was made with the American Ship Windlass Company for two capstans for warping vessels through the Lock.

This contract provided that the speed of the tow line should vary from 20 to 100 feet per minute, the maximum pull should be 5,000 pounds, and the maximum speed for the maximum pull should be 100 feet per minute.

The contract required that the capstans should be complete, with the electric motors and appurtenances, and that the contractor should maintain the capstans for two years.

Some of the anchor bolts to be furnished under this contract were delivered. No payments were made.

Contract No. 38, Westinghouse Electric & Manufacturing Company. — Furnishing Motors for operating Lock-gates, Boston.

Bids were received for four electric motors for operating the Lock-gates, and on May 25, 1906, a contract was made with the Westinghouse Electric and Manufacturing Company for these motors.

The contract provided that each motor should be 50 horse-power, railway type, series wound, complete with automatic solenoid brake.

The price called for in the contract was $2,635.40.

The contract required the maintenance of these motors for two years.

Contract No. 40, Chapman Valve Manufacturing Company. — Furnishing Plug Drain Valves, Boston.

Bids were received for the material called for under this contract, and on June 7, 1906, the contract was placed with the Chapman Valve Manufacturing Company.

The principal items called for under the contract were seven 8-inch valves and thirteen 6-inch valves.

The total amount of the contract was $867.71.

Delivery of the material was called for within sixty days of the date of the contract. The work, however, was not done on time, and the delay caused an additional expense for forms for the concrete in the places where the valves were to be set. This material was all delivered, but at the end of the period covered by this report a final settlement had not been made.

Contract No. 41, Coffin Valve Company. — Furnishing Sluice-gates at the Sluices and Boston Marginal Conduit, Cambridge and Boston.

On June 14, 1906, a contract was made with the Coffin Valve Company for six sluice-gates at the Dam and Lock, with the following dimensions: one rectangular sluice-gate with clear opening 6 feet 4 inches by 6 feet 6 inches; two rectangular sluice-gates with clear openings 7 feet 3 inches by 8 feet 6 inches; one rectangular sluice-gate with clear opening 8 feet by 8 feet; one rectangular sluice-gate with clear opening 4 feet by 6 feet; and one rectangular sluice-gate with clear opening 4 feet 6 inches by 6 feet. The two last-mentioned gates were to be provided with stands for hand operation only. The other gates were to be arranged for either hand or electrical operation. The contract included the electric motors and appurtenances and their erection, complete, as well as the erection of the gates.

Considerable work was done under this contract, and some of the anchor bolts required to be set in the masonry were delivered. No payments were made.

Contract No. 42, New England Structural Company. — Furnishing Steel Beams, Rods and Plates, Boston and Cambridge.

On July 2, 1906, bids were received for furnishing steel beams, rods, plates, etc., to be used mostly for the roofs of the gate-chambers at the sluices and at the outlet of the Boston

Marginal Conduit. On July 5, 1906, the contract was placed with the New England Structural Company for the sum of $4,557.

The contract was completed and final settlement made.

Contract No. 44, Coleman Brothers. — Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment, Boston.

Bids were received under this contract Sept. 10, 1906, and the contract was signed on September 24.

The work under this contract extends from the southerly line of the new Cambridge Bridge to a point between Berkeley and Clarendon streets. It includes the marginal conduit, 2,700 feet long, with an overflow 140 feet long, a retaining wall 2,700 feet long, and connections with the several overflows from the sewer system of the city of Boston between those points, and an earth embankment from 100 to 300 feet in width between the present sea-wall and the proposed Basin wall.

The amount of the contract, on the basis of award, is $232,700.

The principal items of the preliminary estimate were: —

Earth excavation and refill,	160	lin. ft.
Earth filling,	360,000	cu. yds.
Piles in place,	207,000	lin. ft.
Drains,	3,000	lin. ft.
Concrete masonry,	6,300	cu. yds.
Ashlar masonry,	900	cu. yds.
Face dressing of pointed work,	14,500	sq. ft.
Sheeting left in place,	15	M. ft. B. M.
Yellow pine lumber in place in sewer outlets,	35	M. ft. B. M.
Wrought iron and steel in place in sewer outlets,	4,000	pounds.
Iron and other metal work to be placed,	80	tons.

On Oct. 1, 1906, filling from carts was started at the foot of Revere Street, but on October 5 the filling was changed to a point in the rear of the old Eye and Ear Infirmary on Charles Street, near Cambridge Street. On October 22 filling from carts was begun at another point in the angle of the sea-wall on Back Street about 100 feet east of Otter Street.

Excavating for the conduit trench was started in the rear

of the Eye and Ear Infirmary on October 12, and has continued since that time with a small force. Pile-driving was started on the same day. The work of placing concrete was started on November 5.

A dredge began work on October 27.

The total value of the work done, as shown by the November, 1906, estimate, was $15,818.57.

Earth excavation and refill,	60 lin. ft.
Earth filling,	30,243 cu. yds.
Piles in place,	26,645 lin. ft.
Drains,	65 lin. ft.
Concrete masonry,	26 cu. yds.

Contract No. 45, Richard F. Keough. — Furnishing Small Boat Lock-gates, Cambridge.

On Sept. 10, 1906, bids were opened for the four lock-gates for the small boat lock at the sluices, and on Sept. 17, 1906, a contract was made with Richard F. Keough for constructing these gates for the sum of $850.

A small amount of work under this contract was done, but no payments were made.

Contract No. 46, New England Structural Company. — Furnishing Structural Steel, Boston.

On Sept. 17, 1906, bids were received for the structural material, consisting of steel beams for the Lock stop-planks, together with girders and trusses for supporting the same in the Lock, and other structural material required principally at the Lock. On Sept. 19, 1906, a contract for this material was placed with the New England Structural Company for $7,380.

Very little material had been delivered under this contract at the end of the period covered by this report, and no payments had been made.

Contract No. 48, The Lumsden & Van Stone Company. — Furnishing and erecting Steam, Water and Air Piping, Boston.

On Oct. 15, 1906, bids were opened for this work, and on Oct. 20, 1906, a contract was made with The Lumsden & Van Stone Company for $2,098.

The work called for under this contract consisted in furnishing and erecting the steam, water and air piping, with fittings and hangers, which is required inside the Lock-gates for heating, draining and ventilating them. No material has been delivered and no payments have been made.

Contract No. 50, Holbrook, Cabot & Rollins Corporation. — Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment, Boston.

Bids were received for this contract Oct. 29, 1906, and the contract was signed Nov. 5, 1906.

This contract covered the work of building Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment, and extends from a point between Berkeley and Clarendon streets to a point between Fairfield and Gloucester streets, a distance of about 2,400 feet.

The amount of this contract, on the basis of award, is $198,890. The principal items of the preliminary estimate were: —

Earth filling,	145,000	cu. yds.
Piles in place,	172,000	lin. ft.
Drains,	2,500	lin. ft.
Concrete masonry,	5,700	cu. yds.
Ashlar masonry,	900	cu. yds.
Face dressing of pointed work,	14,500	sq. ft.
Yellow pine lumber in place in temporary sewer outlets,	10	M. ft. B. M.
Wrought iron and steel in place in temporary sewer outlets,	2,000	pounds.
Iron and other metal work to be placed,	120	tons.

Work was started Nov. 17, 1906, by a dredge.

Very little work was done during the period covered by this report, and no payments were made.

Contract No. 51, Lynch & Woodward. — Furnishing and erecting a Boiler Plant, Boston.

On Nov. 12, 1906, bids were opened for the work called for under this contract, and on Nov. 28, 1906, this contract was awarded to Lynch & Woodward, but had not been signed at the end of the period covered by this report.

Respectfully submitted,

HIRAM A. MILLER,
Chief Engineer.

Boston, Feb. 27, 1907.

APPENDIX.

Appendix A.

Chapter 465 of the Acts of 1903, as amended by Chapter 65 of the Acts of 1905, and by Chapters 368 and 402 of the Acts of 1906.

An Act to authorize the Construction of a Dam across the Charles River between the Cities of Boston and Cambridge.

Be it enacted, etc., as follows:

Charles river basin commission, appointment, term, etc.

Section 1. The governor of the Commonwealth, with the advice and consent of the council, shall appoint three commissioners, residents of the metropolitan parks district, who shall constitute the Charles river basin commission, hereinafter called the commission, and who shall be sworn before entering upon the duties of their office. One commissioner shall be designated by the governor as chairman, and two commissioners shall constitute a quorum. The term of office shall be three years, and all vacancies shall be filled by the governor, with the advice and consent of the council. Any commissioner may be removed by the governor, with the advice and consent of the council, for such cause as he shall deem sufficient and shall assign in the order of removal. Each commissioner shall receive an annual salary of such amount as the governor and council shall determine.

Compensation.

Powers and duties.

Section 2. The commission may appoint a secretary, engineers and assistants, shall keep accurate accounts of its expenditures, and shall make an annual report of its doings, including an abstract of its accounts, to the governor and council. The commission whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor.

Dam to be constructed across Charles river, etc.

SECTION 3. The commission shall construct across Charles river between the cities of Boston and Cambridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Craigie bridge, which shall be removed by the commission. *The commission may construct or otherwise provide a temporary highway bridge and approaches thereto for the use of teams and pedestrians during the construction of the dam.* The dam shall be not less than one hundred feet in width at said water level and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, wasteways and other appliances.

Navigable channels to be dredged.

SECTION 4. The commission shall dredge navigable channels in the basin from the lock to the wharves between the dam and Cambridge bridge, to Broad canal and to Lechmere canal, the channel to be not less than one hundred feet in width and eighteen feet in depth; shall dredge Broad canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to the Third Street draw, not less than thirteen feet of water from the Third Street draw to the Sixth Street draw, and not less than eleven feet of water from the Sixth Street draw to the railroad draw, and not less than nine feet of water for one hundred and twenty-five feet above the railroad draw; shall dredge Lechmere canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to and including Sawyer's lumber wharf, and not less than thirteen feet of water from said wharf up to the head of the canal at Bent street; all depths aforesaid to be measured from the water level to be maintained in the basin.

Manner of dredging, etc.

The commission shall do all such dredging and all strengthening of the walls of the canals and of the basin where dredging is done by the driving of prime oak piles two feet on centres along the front of said wharves or walls, and all removing and relocating of pipes and conduits made necessary by such dredging, so that vessels requiring a depth of water not exceeding the respective depths above prescribed can lie alongside of, and in contact with, the wharves; and this work shall be done in such manner as to cause the least possible inconvenience to abutters, and shall be finished on or before the completion of the dam; and after the walls or wharves have been so strengthened, all repairs on or rebuilding of the walls and wharves shall be done by the abutters.

Certain other dredging to be done, etc.

The commission shall do such dredging in the basin outside of the channels aforesaid as may be necessary for the removal of sewage, sludge or any offensive deposit; shall do such other dredging as it shall deem proper, and shall take all proper measures for the destruction of malarial mosquitoes in the basin and its vicinity.

Marginal conduits to be constructed, etc.

SECTION 5. The commission, before the completion of the dam, shall construct marginal conduits on the north side of the basin from the outlet of the overflow channel in Binney street to a point below the dam, and on the south side of the basin from the present outlet of the Back Bay Fens to a point below the dam, and may construct an extension thereof toward, or to, St. Mary street, the conduits to be used to receive and conduct below the dam the overflow from sewers and the surface drainage and other refuse matter which would otherwise pass into the basin.

Certain lands, etc., may be taken, etc.

SECTION 6. The commission, for the purpose of carrying out the provisions of the preceding sections, may from time to time take in fee or otherwise, by purchase or otherwise, for the Commonwealth, or the city of Boston or the city of Cambridge, as the commission shall determine, lands, flats and lands covered by tide-water on Charles river, by filing in the registry of deeds for

the county and district in which the lands or flats are situated a description thereof, sufficiently accurate for identification, signed by a majority of the commissioners; and any person whose property is so taken may have compensation therefor as determined by agreement with the commission, and if they cannot agree the compensation may be determined by a jury in the superior court for the county where the property is situated under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission, or by such person, filed in the clerk's office of said court against the Commonwealth or the city for which the lands or flats are taken within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

The metropolitan park commission to have exclusive control of dam, etc.

SECTION 7. The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive *care and* control of the dam and lock *and of any highway, park or parkway, drawbridge or drawbridges, constructed in connection therewith,* and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, *highway, park or parkway, drawbridge or drawbridges,* and of the placing thereof, except the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of *said* basin, *dam, lock, highway, park, parkway, drawbridge or drawbridges, breaches of which rules shall be breaches of the peace, punishable as such,* and throughout the year shall operate the lock *and drawbridge or drawbridges* without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by

May make rules and regulations, etc.

natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency, requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission. *Said metropolitan park commission shall also have and exercise over said basin, dam, lock, highway, park, parkway, drawbridge or drawbridges, all other power, duties and liabilities now imposed upon said commission by chapter four hundred and seven of the acts of the year eighteen hundred and ninety-three, and acts in addition thereto, and in amendment thereof relative to the care, maintenance and control by said commission of open spaces for exercise and recreation so far as the provisions of said acts are consistent with the provisions of this act.*

Notice to be given in case of emergency requiring temporary reduction of level, etc.

Removal of direct sewage or factory waste may be ordered, etc.

SECTION 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of sections *one, two, three, four, five, six, seven, eleven and twelve, as amended,* and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the ex-

Payment of expenses.

Charles River Basin Loan.

penses incurred under *sections one, two, three, four, five, six, eleven and twelve* of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip, and to their payment.

Apportionment of expenses, etc.

SECTION 9. The commissioners appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under *sections one, two, three, four, five, six, seven, eight, eleven and twelve* of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system; *and shall also determine, as they shall deem just and equitable, what portion of the total amount expended for the cost of construction of the marginal conduit on the south side of the basin and of the embankment and park, provided for by this act, shall be apportioned to the city of Boston as the cost of the construction of said embankment and park, and what portion shall be fixed as the cost of said marginal conduit. The cost of the construction of said embankment and park, so apportioned, shall be repaid to the Commonwealth by the city of Boston with four per cent. interest from the date of said apportionment, and bills for the betterments assessed by the Charles river basin commission under the provisions of this act shall be listed and committed to the collector of taxes of the city of Boston, and shall be collected under the same provisions of law as betterments levied for the construction of highways in the city of Boston. All amounts so received by the*

city of Boston from said betterments shall be applied, first toward paying to the Commonwealth said apportionment for the cost of construction of said embankment and park as above provided; and second to the interest and sinking fund requirements of the loan of the city of Boston authorized by this act. The treasurer and receiver-general shall determine the payments to be made each year by *the* cities *of Boston and Cambridge,* one-half by each, to meet the interest and sinking fund requirements for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as part of its state *taxes. The city treasurer of Boston shall from time to time on the request of the mayor issue and sell bonds of the city to meet the payments to the Commonwealth required by this section, and the bonds so issued shall not be reckoned in determining the statutory limit of indebtedness of the city.*

City of Boston to do certain dredging, construct conduits, sewer, etc.

SECTION 10. The city of Boston, by such officer or officers as the mayor may designate, shall forthwith after the passage of this act, do such dredging in the Back Bay Fens as the board of health of said city may require, shall construct a conduit between Huntington avenue and Charles river, to form an outlet into Charles river for the commissioners' channel of Stony brook, shall reconstruct the present connections between the river and the Fens so as to allow free access of water from the river into the streams and ponds in the Fens and thence into the river, and shall construct a sewer in the rear of the houses on the north side of Beacon street between Otter and Hereford streets. Such officer or officers may construct a conduit between Green street and Forest Hills and may construct or rebuild within five years one or more conduits for Stony brook between the westerly side of Elmwood street and the Fens: *provided, however,* that the expense of such conduits between Green street and Forest Hills and between Elmwood street and the Fens shall be paid for out of the annual appropriation for sewer construction under the provisions of chapter four hundred and twenty-six of the

Proviso.

acts of the year eighteen hundred and ninety-seven and acts in amendment thereof or in addition thereto.

Wall or embankment may be built on Boston side of Charles river.

SECTION 11. *The Charles river basin commission shall* build a wall *and* embankment on the Boston side of Charles river beginning at a point in the southwest corner of the stone wall of the Charlesbank, thence running southerly by a straight or curved line to a point in Charles river not more than three hundred feet westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioners' line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from *the* said commissioners' line; thence continuing southerly and westerly by a curved line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall, *but at no point more than one hundred feet distant therefrom* to the *westerly* line of the Back Bay Fens, extended to intersect said parallel line.

Certain lands, flats, etc., may be taken for a public park.

SECTION 12. *The Charles river basin commission shall acquire in fee, or otherwise, by purchase or otherwise, for the city of Boston, for the purpose of a public park, parkway or street, flats and lands covered by tide water and lying easterly of Charlesgate West by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of said commission, and shall construct a public park or lay out a parkway or street,*

Proviso.

on the lands so taken: provided, however, that nothing herein contained shall authorize the taking for any purpose of Back street, or of any lot or part of any lot on the north side of Beacon street or of any flats or lands covered by tide water south of West Boston bridge and lying between the line of the wall the construction whereof is provided for in section eleven of this act and the Cambridge shore, nor the taking for any purpose but that of a public park of any flats or land covered by tide water between said wall and the sea wall as at present existing; and any person whose property

is so taken may have compensation therefor as determined by agreement with the commission, or, in the absence of such agreement, the amount thereof may be determined by a jury in the superior court for the county of Suffolk upon petition therefor by the commissioners or by such person, filed in the clerk's office of said court, against the Commonwealth, and within one year after the taking, and under the same proceedings and provisions of law, so far as they may be applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws. And because of the construction and maintenance of the embankment and park as herein provided, and the establishment of the northerly line thereof as herein finally fixed and defined as the limit of any embankment or construction northerly from Beacon street between the Charlesbank and the Back Bay Fens, said commission shall within two years after the completion of the park as herein provided and defined determine the value of the benefit or advantage, from the establishment of said embankment and park, beyond that resulting to all real estate in the city of Boston, to each parcel of real estate east of the Back Bay Fens bordering upon or near said embankment and park as so completed, and shall assess such betterment upon the said estates so benefited; but such assessments shall in no event exceed in the aggregate one-half of the actual cost of construction of said embankment and park, exclusive of the cost of the marginal conduit, nor the sum of thirty dollars for each lineal front foot of private ownership. Any person aggrieved by such assessment of betterments may within one year thereafter file a petition in the superior court for the county of Suffolk, and after notice to the city of Boston shall have a trial by jury therein, and costs shall be awarded as provided in section seven of chapter fifty of the Revised Laws.

City of Boston to pay certain expenses, etc.

SECTION 13. The city of Boston shall pay the expenses incurred under *section ten* of this act, except as otherwise provided in *said section ten;* and to meet said expenses the city treasurer of the city shall, from time

City treasurer to issue bonds, etc.

to time, on the request of the mayor, issue and sell bonds of the city to an amount not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

The Boston and Maine Railroad to remove certain structures, etc.

SECTION 14. The lock shall be built above the lower line of the dam, and the Boston and Maine Railroad shall, before the dam is completed, remove its bridge, piles and any other structures in Charles River which are southerly or westerly of a line defined in red on a plan filed in the office of the board of harbor and land commissioners marked "Plan showing line from above or southwest of which the Boston & Maine Railroad shall remove all of its structures in Charles River and between the harbor lines, May 25, 1903. Woodward Emery, Chairman of Harbor and Land Commissioners"; and may rebuild the same northerly and easterly of the line so defined. The draw in the new bridge shall not be easterly of nor more than fifty feet westerly from the location of the present draw, and shall be so located as to be directly opposite the lock. Within the limits herein prescribed the commission shall determine the position of the lock and draw.

Enforcement of provisions of act, etc.

SECTION 15. The supreme judicial court and the superior court shall, upon application of any party in interest, including any owner or occupant of property abutting on the basin or on Broad canal or Lechmere canal, have jurisdiction to enforce, or prevent violation of, any provision of this act and any order, rule or regulation made under authority thereof.

Repeal.

SECTION 16. Chapter three hundred and forty-four of the acts of the year eighteen hundred and ninety-one, as amended by section one of chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three, and chapter five hundred and thirty-one of the acts of the year eighteen hundred and ninety-eight are hereby repealed.

When to take effect.

SECTION 17. This act shall take effect on the first day of July in the year nineteen hundred and three.

The following section, being section 3 of chapter 368 of the Acts of 1906, constitutes an addition rather than an amendment to chapter 465 of the Acts of 1903: —

When dam is completed the Charles river basin commission to certify the same, etc.

When the work of the Charles river basin commission as provided for in said chapter four hundred and sixty-five is finished, said commission shall certify the fact in writing to the metropolitan park commission, and such certificate or a copy of the same, attested by any member of the metropolitan park commission or by its secretary, shall be prima facie evidence that the exclusive care and control of said dam, lock, highway, park or parkway, drawbridge or drawbridges, are vested in the metropolitan park commission.

Chapter 107 of the Resolves of 1904.

Resolve to provide for the Acceptance by the Commonwealth of the Conditions and Limitations set forth in a Certificate of the Acting Secretary of War of the United States relating to the Construction and Maintenance of the Charles River Dam.

Construction of Charles river dam, etc., acceptance of certain conditions, etc.

Resolved, That the express conditions and limitations set forth in a certificate of Robert Shaw Oliver, acting secretary of war, under date of the eighteenth day of May, nineteen hundred and four, relating to the construction and maintenance of a dam across the Charles river, and to the maintenance of channels in connection therewith, be, and hereby are, accepted, and the obligations thereof assumed by the Commonwealth, as follows: —

1. That detailed plans for the lock and dam, and of all channels to be dredged outside established harbor lines, shall be submitted to the secretary of war, and that the work be not begun until such plans have received his approval.

2. That the Charles River basin commission, or its successors, shall operate the lock, at their own expense,

as a free navigable waterway of the United States, subject to such regulations as the secretary of war may promulgate.

3. That the emptying of the basin shall be subject to regulation by the secretary of war.

4. That the Charles River basin commission shall dredge and maintain in the basin, from the head of the lock to the channel in the river, a channel one hundred feet wide and eighteen feet deep at mean low water, in a location to be approved by the secretary of war.

5. That whenever called upon to do so by the secretary of war, the Charles River basin commission shall deepen two and two tenths feet the channel eighty feet wide called for by the present approved project for the improvement of Charles river by the United States, known as the project of June fourteen, eighteen hundred and eighty, the said deepening to extend as far as Brackett's wharf.

6. That the Commonwealth of Massachusetts shall maintain in the Charles river from the head of the thirty-five foot channel at Charles river bridge to the dam and lock, the necessary depth and width of channel for the commerce of the river, as fixed by the secretary of war.

7. That the alterations in the bridge of the Boston and Maine Railroad ordered by said act of the general court of Massachusetts shall be made, approval of the plans by the secretary of war being obtained, as required by law.

8. That the approval hereby granted shall not be construed as authorizing any invasion of property rights, or any act whereby a claim for damages against the United States might arise. [*Approved June 8, 1904.*

CHAPTER 158 OF THE ACTS OF 1906.

AN ACT TO PROHIBIT THE POLLUTION OF THE CHARLES RIVER WITHIN THE METROPOLITAN PARKS DISTRICT.

Be it enacted, etc., as follows:

The state board of health may prohibit the discharge of sewage into Charles river, etc.

SECTION 1. The state board of health is hereby authorized, upon the petition of the metropolitan park commission, or the mayor of any city or the selectmen of any town within the metropolitan parks district, and after notice to all parties interested and a hearing, to prohibit the entrance or discharge of sewage into that part of the Charles river within the present boundaries of said metropolitan parks district, and to prevent the entrance or discharge of every other substance, except surface or storm water, into said river within said parks district which may be injurious to public health, or may tend to create a public nuisance, or to obstruct the flow of water within said parks district, including all waste or refuse from any factory or other establishment where persons are employed, unless the owner thereof shall use the best practicable and reasonably available means to render such waste or refuse harmless.

Jurisdiction.

SECTION 2. The supreme judicial court or any justice thereof and the superior court or any justice thereof shall have jurisdiction in equity to enforce the provisions of this act and any order made by the state board of health in conformity therewith. Proceedings to enforce any such order shall be instituted and prosecuted by the attorney general upon the request of the state board of health.

SECTION 3. This act shall take effect upon its passage. [*Approved March 14, 1906.*

APPENDIX B.

CONTRACTS MADE AND PENDING,

1.	1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID. 4. Next to Lowest.	AMOUNT OF BID. 5. Lowest.	6. Contractor.
1	1	Dam and Lock in the Charles River.	11	$801,607 50 [1]	$761,900 00	Holbrook, Cabot & Rollins Corporation.
2	2	Wooden block paving for temporary bridge.	–[2]	–[2]	11,700 00	United States Wood Preserving Company.
3	3[3]	Section 2 of the Boston Marginal Conduit.	10	53,309 25	50,600 00 [1]	James Driscoll & Son.
4	4[3]	Cast-iron pipes and special castings.	2	6,590 12	5,640 75 [1]	Camden Iron Works.
5	5	Furnishing and erecting pumps.	2	9,533 00 [1]	7,423 00	Henry R. Worthington.
6	6[3]	Castings and other metal.	–[2]	–[2]	6,013 74	Gibby Foundry Company.
7	13[3]	Twisted steel rods for reenforcing concrete.	2	5,219 20 [1]	5,049 12 [4]	Aberthaw Construction Company.
8	14[3]	Castings for overflow, Boston Marginal Conduit.	3	749 00	736 80 [1]	Gibby Foundry Company.
9	15[3]	Composition at Dam and Lock.	3	1,821 00	1,773 44 [1]	Coffin Valve Company.
10	16[3]	Brackets for lock-gate bearings at Lock.	2	1,343 33	1,301 30 [1]	The Boston Bridge Works.
11	17[3]	Welded pipe for electric conduits under Lock.	3	4,385 00	3,965 00 [1]	The Lumsden & Van Stone Company.
12	18[3]	Gate valves at Lock, .	3	861 95 [1]	858 39 [5]	The Ludlow Valve Manufacturing Company.
13	19	Plans, specifications, engineering and patent rights for superstructure, operating machinery, etc., for drawbridge over Lock.	–[2]	–[2]	4,500 00 [1]	The Scherzer Rolling Lift Bridge Company.
14	20[3]	Hard pine lumber for planking temporary bridge.	2	3,400 00	2,955 00 [1]	George McQuesten Company, Boston, Mass.
15	21[3]	Spruce lumber for planking temporary bridge.	2	1,040 00	1,040 00 [1]	E. D. Sawyer Lumber Company, East Cambridge, Mass.

[1] Contract based upon this bid.
[2] Competitive bids were not received on this contract.
[3] Contract completed.

APPENDIX B.

OCT. 1, 1905, TO NOV. 30, 1906.

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1906.	
Jan. 14, '05,	July 15, '08,	–	– –	$860,000 00	$408,709 83	1
Mar. 23, '05,	May 12, '05,	–	– –	11,700 00	4,782 52	2
June 13, '05,	Nov. 20, '05,	June 30, '06,	– –	52,383 10	52,383 10	3
July 18, '05,	Sept. 16, '05,	Jan. 22, '06,	– –	5,833 86	5,833 86	4
Sept. 30, '05,	–	–	– –	9,533 00	2,859 90	5
July 27, '05,	Apr. 1, '06,	May 15, '06,	– –	6,262 48	6,262 48	6
May 29, '05,	Sept. 15, '05,	Oct. 12, '05,	– –	5,388 72	5,388 72	7
July 22, '05,	Sept. 1, '05,	Nov. 9, '05,	– –	736 80	736 80	8
July 31, '05,	Oct. 20, '05,	Feb. 7, '06,	– –	1,803 89	1,803 89	9
Aug. 2, '05,	Oct. 20, '05,	Oct. 26, '05,	– –	1,308 67	1,308 67	10
Aug. 18, '05,	Oct. 17, '05,	Mar. 17, '06,	– –	3,975 75	3,975 75	11
Aug. 25, '05,	Apr. 1, '06,	Mar. 16, '06,	– –	861 95	861 95	12
Aug. 25, '05,	–	–	– –	4,500 00	3,500 00	13
Nov. 6, '05,	–	Nov. 24, '05,	For 3-inch plank, planed, $35 per M. ft. B.M.; unplaned plank, $33 per M. ft. B. M.	3,394 69	3,394 69	14
Nov. 9, '05,	–	Dec. 15, '05,	For 2-inch plank, $26 per M. ft. B. M.	1,033 76	1,033 76	15

[4] Bid did not comply with requirements for delivery.
[5] Bid based on furnishing part sluice-gates.

CONTRACTS MADE AND PENDING,

1.	1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID. 4. Next to Lowest.	AMOUNT OF BID. 5. Lowest.	6. Contractor.
1	22[1]	Borings at Lock and sluices.	–[2]	–[2]	–[2]	Gow & Palmer, Boston, Mass.
2	23	Piles along walls of canals and Basin.	–[2]	–[2]	$55,117 26[3]	Holbrook, Cabot & Rollins Corporation.
3	24	Scherzer rolling lift bridge.	7	$41,562 00	40,800 00[3]	American Bridge Company of New York, New York, N. Y.
4	25	Sluice-gates at the sluices in the Dam.	2[4]	27,993 00	24,800 00[3]	Coffin Valve Company.
5	26[1]	22-foot whale-boat launch.	–[2]	–[2]	525 00[3]	E. Gerry Emmons Corporation, Boston, Mass.
6	27	Sluice-gates on the lock-gates in the Lock.	–[2]	–[2]	17,093 00[3]	Coffin Valve Company.
7	28	Tide-gates at the Dam and Lock.	2	4,907 00	4,438 00[3]	Coffin Valve Company.
8	29[1]	Twisted steel rods for reenforcing concrete.	4	3,429 08	3,371 03[3]	Aberthaw Construction Company.
9	30	Lock-gates, . .	4	30,975 00	26,784 00[3]	New Jersey-West Virginia Bridge Company, New York, N. Y.
10	31[1]	Axles for Lock-gate trucks.	–[2]	–[2]	1,930 00[3]	The William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa.
11	32	Spruce lumber for repairing temporary bridge.	4	2,600 00	2,440 00[3]	George W. Gale Lumber Company, Cambridge, Mass.
12	33	Castings and other metal.	2	3,285 63	2,025 10[3]	Chelmsford Foundry Company, Boston, Mass.
13	34	White oak lumber for Lock.	1	–	646 43[3]	George McQuesten Company.
14	35	Castings and other metal.	1	–	3,322 00[3]	Gibby Foundry Company.

[1] Contract completed.

[2] Competitive bids were not received on this contract.

OCT. 1, 1905, TO NOV. 30, 1906 — *Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1906.	
Nov. 6, '05,	–	Jan. 8, '06,	For borings, $0.65 per. lin. ft.	$1,681 03	$1,681 03	1
Dec. 4, '05,	–	–	For oak piles driven, $14 per pile; oak piles over 42 feet in length an additional price of $0.40 per lin. ft. for each foot of excess; long leaf yellow pine lumber in place, $57 per M. ft. B. M.; iron or steel in place, $0.03 per lb.	72,360 00	43,587 98	2
Mar. 16, '06,	–	–	For the whole work, $40,800.	40,800 00	2,026 19	3
Mar. 16, '06,	–	–	For the whole work, $24,800.	24,800 00	–	4
Feb. 27, '06,	Mar. 9, '06,	Mar. 20, '06,	For the whole work, $525.	525 00	525 00	5
Mar. 6, '06,	–	–	For the whole work, $17,093.	17,093 00	–	6
Mar. 16, '06,	–	–	For the whole work, $4,438.	4,438 00	2,662 80	7
Mar. 10, '06,	May 11, '06,	May 18, '06,	For square twisted steel rods, $1.90 and $2.10 per hundred lbs.	3,461 66	3,461 66	8
June 13, '06,	–	–	For the whole work, $26,784.	26,784 00	–	9
Apr. 3, '06,	May 3, '06,	June 18, '06,	For forged Parsons' manganese bronze axles, $0.295 per lb.	1,929 60	1,929 60	10
Apr. 4, '06,	Jan. 1, '07,	–	For 2-inch spruce plank, $24.40 per M. ft. B. M.	3,600 00	3,479 10	11
May 23, '06,	July 22, '06,	–	For iron castings, $0.0215 and $0.02 per lb; checkered steel plate, $0.06 per lb.	2,025 10	606 47	12
Apr. 11, '06,	July 10, '06,	–	For white oak lumber, $65 per M. ft. B. M.	646 43	54 15	13
May 29, '06,	July 28, '06,	–	For bollards, $51.50 each; material for sheaves, $570; other iron castings, $0.0365 per lb.	3,322 00	2,247 67	14

[3] Contract based upon this bid.

[4] Bids were based on different plans and specifications.

CONTRACTS MADE AND PENDING,

1.	1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID. 4. Next to Lowest.	AMOUNT OF BID. 5. Lowest.	6. Contractor.
1	36[1]	Twisted steel rods for reenforcing concrete.	3	$707 31	$694 16[2]	Fred A. Houdlette & Son, Boston, Mass.
2	37	Electric dock capstans at Lock.	2[3]	2,100 00[2]	1,676 00	American Ship Windlass Company, Providence, R. I.
3	38	Motors for operating Lock-gates.	2	2,700 00	2,635 40[2]	Westinghouse Electric & Manufacturing Company, Boston, Mass.
4	39[1]	Crane rail for Lock-gates.	—[4]	—[4]	935 00[2]	H. W. Hayes & Co., Boston, Mass.
5	40	Plug drain valves, .	2	1,096 00	867 71[2]	Chapman Valve Manufacturing Company, Indian Orchard, Mass.
6	41	Sluice-gates at the sluices and Boston Marginal Conduit.	—[4]	—[4]	11,862 00[2]	Coffin Valve Company.
7	42[1]	Steel beams, rods and plates.	9	4,668 00	4,557 00[2]	New England Structural Company, Boston, Mass.
8	43	Manganese bronze studs and bolts.	—[4]	—[4]	770 09[2]	The William Cramp & Sons Ship & Engine Building Company.
9	44	Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment.	7	241,845 00	232,700 00[2]	Coleman Brothers, Charlestown, Mass.
10	45	Small boat lock-gates, .	4	1,337 50	850 00[2]	Richard F. Keough, East Boston, Mass.
11	46	Structural steel, . .	3	7,380 00[2]	7,200 00[5]	New England Structural Company.

[1] Contract completed.
[2] Contract based upon this bid.
[3] Bids were upon different types of capstans.

OCT. 1, 1905, TO NOV. 30, 1906 — *Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1906.	
May 23, '06,	June 15, '06,	Aug. 31, '06,	For square twisted steel rods, $1.925 per hundred lbs.	$682 81	$682 81	1
May 24, '06,	–	–	For the whole work, $2,100.	2,100 00	–	2
May 25, '06,	–	–	For the whole work, $2,635.40.	2,635 40	–	3
May 26, '06,	Aug. 1, '06,	Sept. 1, '06,	For the rail, including splice bars, bolts and nuts, $0.0425 per lb.	944 20	944 20	4
June 7, '06,	Aug. 6, '06,	–	For 8-inch valves, $57.53 each; 6-inch valves $31.95 and $35.49 each.	867 71	–	5
June 14, '06,	–	–	For the whole work, $11,862.	11,862 00	–	6
July 5, '06,	Sept. 3, '06,	Nov. 17, '06,	For the whole work, $4,557.	4,557 00	4,557 00	7
June 15, '06,	July 15, '06,	–	For stud bolts, $0.49 per lb.; lag screws, $0.3325 per lb.	770 09	–	8
Sept. 24, '06,	Jan. 1, '08,	–	For earth excavation and refill, $20 per lin. ft. of trench; earth filling, $0.27 and $0.50 per cu. yd.; piles, $0.14 and $0.20 per lin. ft.; drains, $0.60 per lin. ft.; concrete masonry, $8 and $7 per cu. yd.; ashlar masonry, $16 and $30 per cu. yd.; face dressing of pointed work, $0.40 per sq. ft.; sheeting, $30 per M. ft. B. M.; yellow pine lumber, $50 per M. feet B. M.; wrought iron and steel, $0.07 per lb.; placing iron and other metal work, $40 per ton of 2,000 lbs.	232,700 00	13,445 78	9
Sept. 17, '06,	–	–	For the whole work, $850.	850 00	–	10
Sept. 19, '06,	Dec. 18, '06,	–	For the whole work, $7,380.	7,380 00	–	11

[4] Competitive bids were not received on this contract.
[5] Bid did not comply with requirements for delivery.

CONTRACTS MADE AND PENDING,

	1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID. 4. Next to Lowest.	5. Lowest.	6. Contractor.
1	47	Yellow pine timber for Lock stop-planks.	2	$763 20	$742 00[1]	George McQuesten Company.
2	48	Steam, water and air piping.	9	2,158 00	2,098 00[1]	The Lumsden & Van Stone Company.
3	49	Small boat lock-gate hinges.	—[2]	—[2]	1,260 00[1]	The William Cramp & Sons Ship & Engine Building Company.
4	50	Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment.	5	200,860 00	198,890 00[1]	Holbrook, Cabot & Rollins Corporation.
5	52	Twisted steel rods for reenforcing concrete.	4	1,726 07	1,706 23[1]	Aberthaw Construction Company.
		Totals, . .	. .	. . .	. . .	. . . . .

[1] Contract based upon this bid.

[2] Competitive bids were not received on this contract.

OCT. 1, 1905, TO NOV. 30, 1906 — *Concluded.*

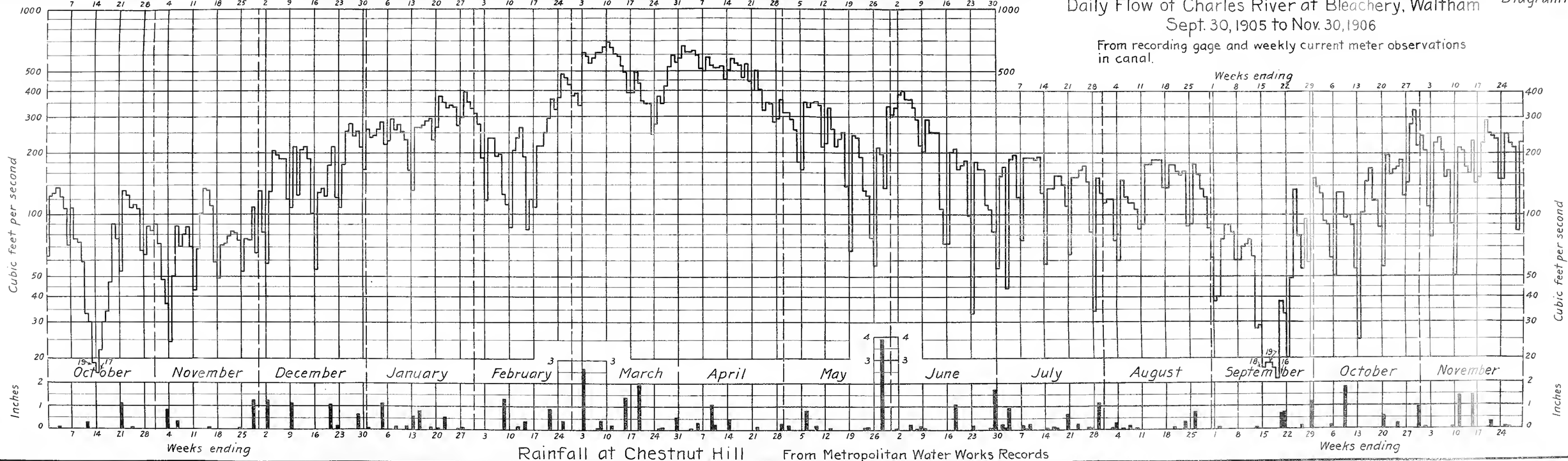
7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1906.	
Sept. 13, '06,	Nov. 12, '06,	–	For yellow pine timber, $35 per M. ft. B. M.	$742 00	–	1
Oct. 20, '06,	–	–	For the whole work, $2,098.	2,098 00	–	2
Sept. 24, '06,	Nov. 1, '06,	–	For the whole work, $1,260.	1,260 00	–	3
Nov. 5, '06,	Jan. 1, '08,	–	For earth filling, $0.40, $0.53 and $0.68 per cu. yd.; piles $0.17 and $0.20 per lin. ft; drains, $0.60 per lin. ft.; concrete masonry $12 and $8 per cu. yd.; ashlar masonry, $18.50 and $25 per cu. yd.; face dressing of pointed work, $0.60 per sq. ft.; yellow pine lumber, $60 per M. ft. B. M.; wrought iron and steel, $0.05 per lb.; placing iron and other metal work, $25 per ton of 2,000 lbs.	198,890 00	–	4
Oct. 17, '06,	Feb. 1, '07,	–	For square twisted steel rods, $1.95 and $2.15 per hundred lbs.	1,706 23	225 31	5
. . .	. . .	. . .	. . . .	$1,642,227 93	$584,952 67	

[3] Two lower bids, for $2,030 and $2,068 respectively, were informal, — not in accordance with the requirements of "Information for bidders."

Diagram No. 1

Daily Flow of Charles River at Bleachery, Waltham
Sept. 30, 1905 to Nov. 30, 1906

From recording gage and weekly current meter observations in canal.



Rainfall at Chestnut Hill From Metropolitan Water Works Records

COMMONWEALTH OF MASSACHUSETTS

CHARLES RIVER BASIN COMMISSION

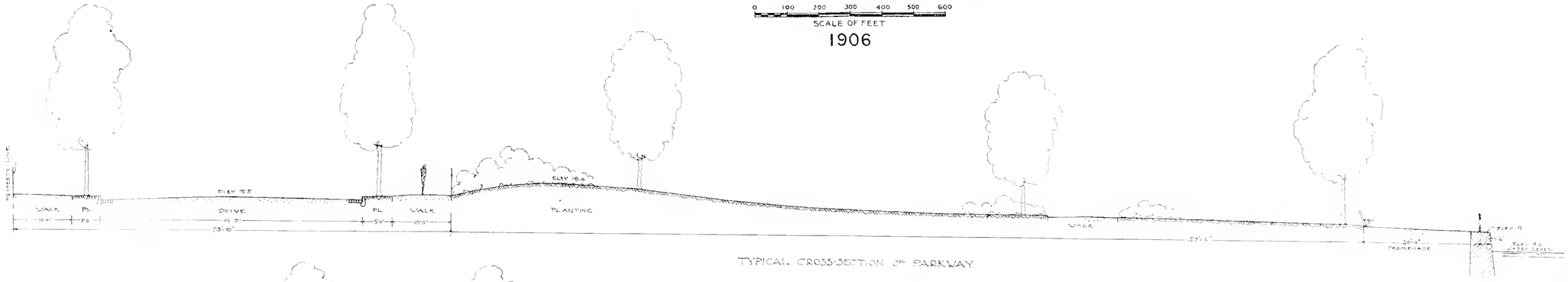
BOSTON EMBANKMENT

CAMBRIDGE BRIDGE TO HARVARD BRIDGE

0 100 200 300 400 500 600

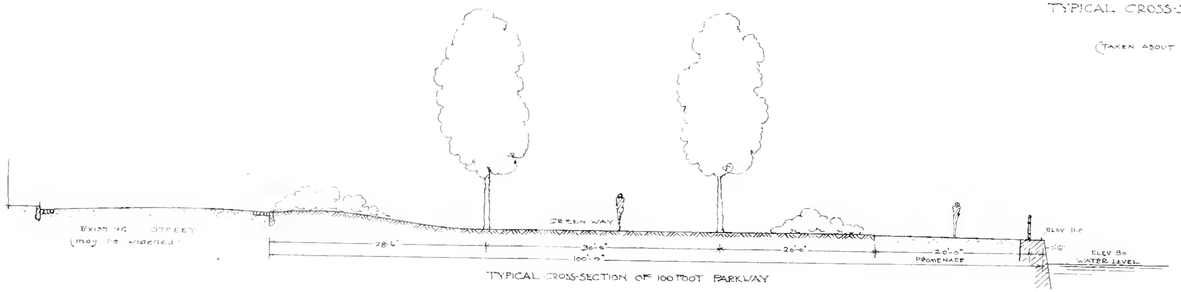
SCALE OF FEET

1906



TYPICAL CROSS-SECTION OF PARKWAY

(TAKEN ABOUT PINCKNEY STREET)



TYPICAL CROSS-SECTION OF 100 FOOT PARKWAY

SCALE OF SECTIONS

0 5 10 15 20 25 30

FEET

CHARLES RIVER

CAMBRIDGE BRIDGE

REVERE ST

PINCKNEY ST

CHARLES STREET

MT VERNON ST

LIME ST

CHESTNUT ST

BRIMMER ST

OTTER ST

CHARLES STREET

BEACON STREET

PUBLIC GARDEN

ARLINGTON ST

HARVARD BRIDGE

PUBLIC LANDING

PROMENADE

EXISTING STREET

BEACON STREET

MASS AVE

HEREFORD ST

GLOUCESTER ST

FAIRFIELD ST

EXETER ST

DARTMOUTH ST

CLARENDON ST

BERKELEY ST

Diagram No. 3

Monthly Tonnage passing Draw of Craigie Bridge since Nov. 30, 1899

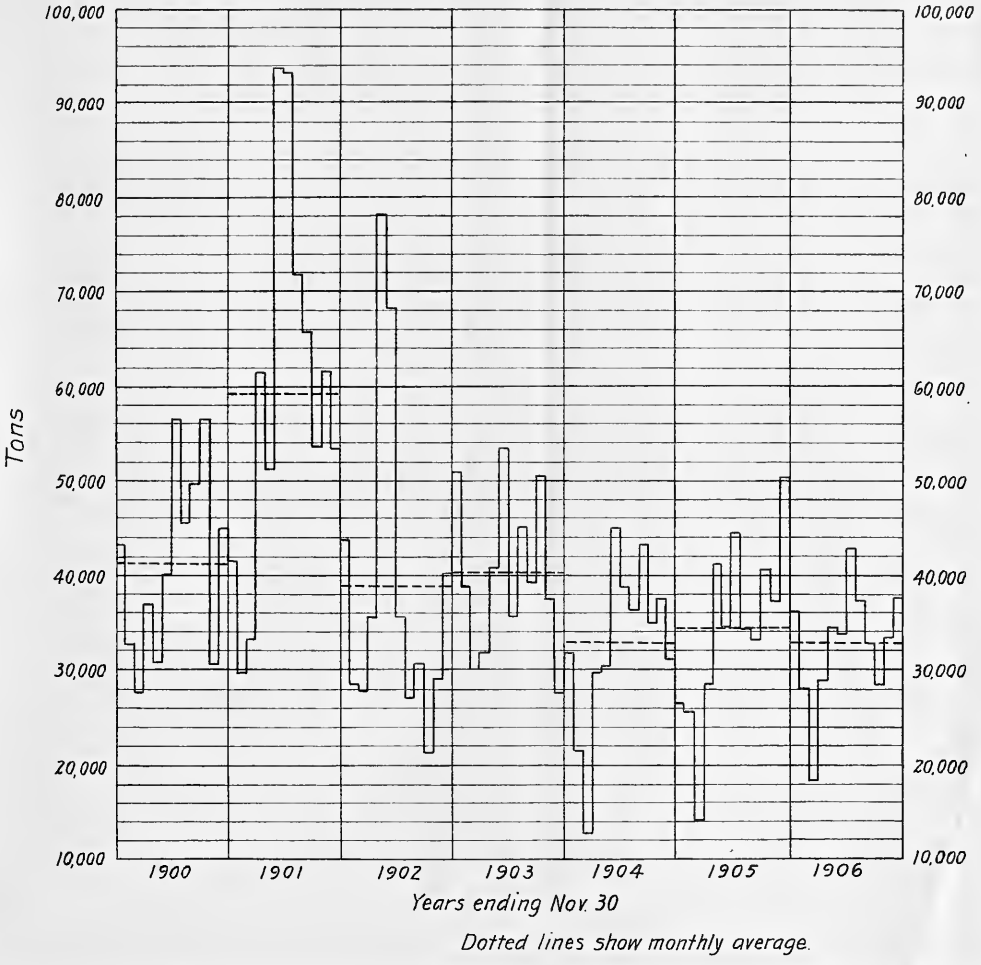
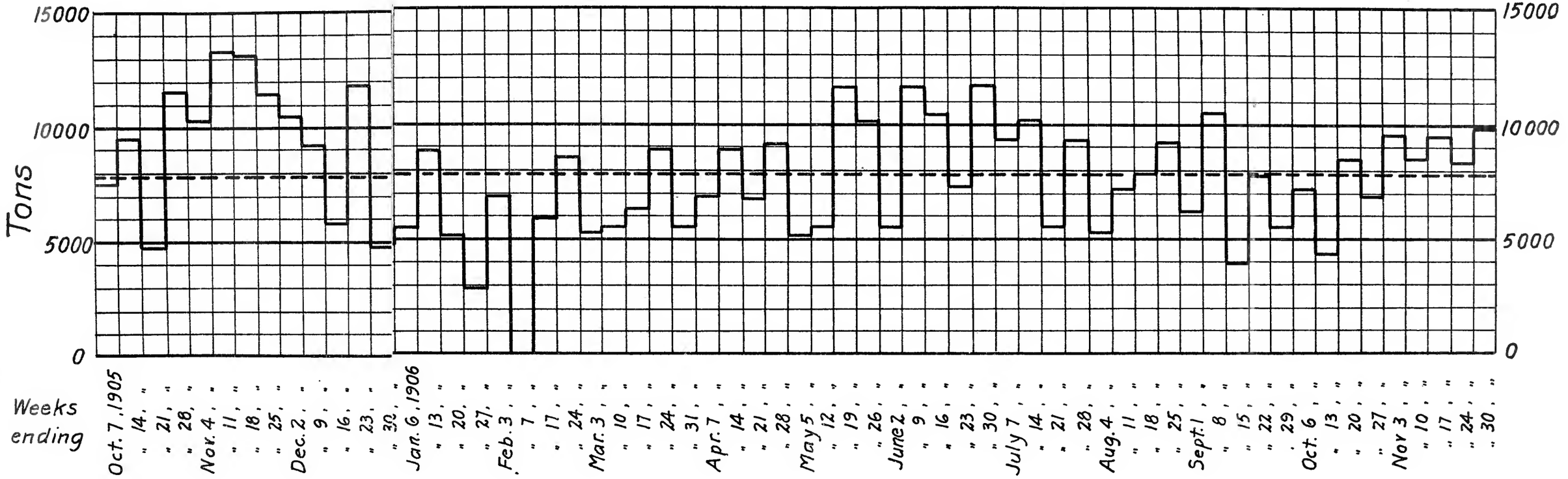


Diagram No. 2

Weekly Tonnage passing draw of Craigie Bridge

Sept. 30, 1905 to Nov. 30, 1906



Dotted line is weekly average

Diagram No. 4

Yearly Traffic through Draw of Craigie Bridge